Bronze Age urned cremation burials of Mainland Scotland: mortuary ritual and cremation technology

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Abstract

Tracing the treatment of the body before, during and after cremation, this thesis aims to reconstruct and theorise the mortuary rituals associated with urned cremation burial in Bronze Age Scotland. It is an attempt to bridge the gap between theoretical perspectives from funerary archaeology and up-to-date methods for understanding heat-related changes to bone from osteoarchaeology and forensic anthropology. As with other types of mortuary treatment, the physical aspects of cremation detected by osteological analysis are interconnected with the meaning and symbolism of the ritual.

The research involved the osteological analysis of a sample of urned cremation burials from the collections of The National Museums of Scotland. The analysis aimed to estimate not only the age at death and sex of the remains, but also to investigate factors such as the number of individuals in an urn, the effectiveness of the cremation process, whether the bodies had been cremated as fresh corpses or dry bones, the position of the body on the pyre, the range of pyre goods and the selection of remains included in the urns. In total, 75 urned cremation burials from 50 sites were analysed, a significant addition to the corpus of osteologically analysed Bronze Age urned burials from the Scottish Mainland. The results suggested a significant discrepancy between how fleshed bodies and bodies which had been through the pyre were perceived. Whereas fresh corpses were not modified, the burnt remains could be extensively manipulated until their final deposition within the urn.

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Declaration

This is to certify that that the work contained within has been composed by me and is entirely my own work. No part of this thesis has been submitted for any other degree or professional qualification.

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Cecilia Medina-Pettersson

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Dedication

I dedicate this thesis to the memory of my grandmother, Maria Ramirez Castillo (1930-2011).

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Any omissions and mistakes are entirely my own.

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Chapter 1

Introduction

1.1 Rationale

Research on Scottish Bronze Age burial dates back almost two centuries (Jamieson, 1822). It is likely that visible monuments such as cairns and stone circles, as well as accidental discoveries of hoards and burials would have intrigued people even before that. Due to the prominence of Bronze Age burial and ritual monuments in the archaeological record, they, and the material culture associated with them, were traditionally the main source of knowledge of the period (e.g. Evans, 1881; Abercromby, 1912a). Even though human remains were analysed from early on, the focus of Bronze Age burial research traditionally lay on grave goods and funerary pottery (e.g. Evans, 1881; Abercromby, 1912a; Coles, 1969; Clarke, 1970a). There are relatively few studies of human remains, particularly cremated remains (Medina-Pettersson, 2008).

The last two decades have seen an increase in cremation studies, both osteological (e.g. Fairgrieve, 2008; Schmidt and Symes, 2008) and theoretical (e.g. Williams, 2004; Rebay-Salisbury and Stig Sørensen, 2008a; Stig Sørensen, 2010), and there is now a wider knowledge of how the study of human remains can be used to recreate and understand mortuary ritual. Furthermore, developments in radiocarbon dating cremated remains (Lanting et al., 2001) have resulted in a large number of new radiocarbon dates from Scottish Bronze Age urned burials (Sheridan, 2002, 2003b, 2004b, 2005, 2006, 2007c, 2008a; Johnson and Cameron, 2013). Combined, these factors greatly enhance any knowledge that can be obtained from cremated remains, making cremation studies critical for increasing our understanding of mortuary ritual in the Bronze Age.

Although cremation was practiced in Scotland already during the Neolithic, urned cremation burial, introduced a century or so into the Bronze Age (c. 2200 BC) (Sheridan, 2004a, 261), was a Bronze Age innovation. The custom of carefully collecting all or parts of the cremated remains from the pyre and placing them in a sturdy urn was radically different from the Neolithic custom of scattering cremated remains before covering them. During the Bronze Age, urned cremation co-existed with other types of cremation burial. It increased in popularity throughout the Earlier Bronze Age, and even survived into the Later Bronze Age. Some earlier studies of cremation in Bronze Age Britain have treated cremation as a monolithic practice, using cremation burials from a variety of contexts, including both typical graves as well as other features with cremated human bones, such as pyre sites and redeposited pyre debris (e.g. McKinley, 1997; Medina-Pettersson, 2008; Brück, 2009). Others have focused on the typology of the urns, with less details on the contents (e.g. Cowie, 1978; Longworth, 1984).

There is no study that singles out urned cremation burials, but there is a case for arguing that it is a distinct enough phenomenon to be worthy of study. Urned cremation burials placed in different types of urns show strong similarities, including the types of sites they are found on and the pyre goods associated with them (Sheridan, 2007a). Urned cremation burial also differs from other types of cremation burial practiced during the Late Neolithic and the Bronze Age in the treatment of the body. Unlike cremation burials in which the cremated remains are scattered, the urn represents an effort to protect the remains and, in a sense, re-create the body (Rebay-Salisbury and Stig Sørensen, 2008b, 61).

The research for this thesis is based on the osteological analysis of the cremated remains found in 75 urns from 50 sites on the Scottish Mainland, a significant contribution to the number of recently analysed urned cremation burials from the Scottish Mainland. All cremation burials, except two, were borrowed from the collections of the National Museums Scotland (NMS), and were selected in collaboration with Dr Alison Sheridan, Principal Curator of Early Prehistory.

The only exceptions were the two cremation burials from Glenluce Sands, which were on loan to the NMS for radiocarbon dating. Through cremation analysis it is possible to reconstruct aspects such as sex, age, efficiency of cremation, whether the body was fleshed or not as well as the selection of the remains to be buried. As with other types of mortuary treatment, the physical aspects of cremation detected by osteological analysis are interconnected with theoretical aspects of the ritual.

1.2 Aims

The thesis aims to reconstruct the sequence of the mortuary rituals surrounding cremation. Although not every step of the mortuary ritual can be reconstructed from the appearance of the bones and the associated pyre goods, enough of it can be reconstructed to give a broad outline of the ritual sequence.

As the body is central to the mortuary ritual, the body is also the focus of the thesis. The research is designed to answer the questions of what happened to the body before, during and after cremation:

- Before cremation: Who was cremated (age, sex, MNI)? Were bodies cremated as complete bodies or as dry bones? What was the position of the body on the pyre? What sort of pyre goods did they receive?

- During cremation: How efficient was the cremation process? Was the pyre tended?

- After cremation: How much of the pyre goods and human remains were collected from the pyre and buried?

This is explored through osteological analysis. In addition to standard osteological procedures to estimate sex, age and Minimum Number of Individuals (MNI), matters more specific to understanding the cremation process will be addressed.

- A database will be constructed to record data relating to each identifiable fragment as well as to each deposit.

- Each deposit will be sieved using a stack of 10, 5 and 2 mm sieves. Together with measurements of the longest cranial and postcranial fragments, this will serve as measures of fragmentation, used to infer tending of the pyre and method of collecting the remains from the pyre site for burial.
- The combined weights of the sieves, picked free of extraneous material, will be compared to the expected weight of a cremated body, to infer how much of the body was buried.
- The identified material will be ordered into the four main parts of the body (skull, axial skeleton, upper and lower limb) and weighed, so that the representation of different parts of the body can be compared.
- The main colour, as well as areas of poor calcination of each identified fragment will be recorded to provide data on position on the pyre, state of the body when cremated and efficiency of cremation.
- Pyre goods will be identified and recorded.

1.3 Defining cremation

Cremation refers to a mortuary treatment in which a corpse is burnt until all of the soft tissues have disappeared and the bones have been reduced to ashes. In order for burnt bones found in the archaeological record to classify as cremation burials, the purpose and intents behind the burning need to be taken into account. Throughout this thesis, cremation is understood to be the deliberate burning and reduction to bone fragments of a dead individual as a crucial part of a socially sanctioned mortuary ritual.

Not all burnt bones seen in the archaeological record are cremated. Burnt animal, and sometimes human, bones, can be the result of cooking, or of refuse being used for fuel (Whyte, 2001). Bone charcoal, bone that has been burnt in a reducing environment, was used in Iron Age Scandinavia to make steel (Gansum, 2004). In some cases, bone ends up burnt because fires have been lit on top of already buried bones (Bennett, 1999). Even purposeful burning of humans in a ritualised context does not automatically amount to cremation. Burning has been used as a means of execution at least since the Iron Age (Green, 2001), and was one of the methods used in medieval and early modern Europe to execute those found guilty of heresy and witchcraft (Behringer, 2004). Partial burning of corpses or bones as parts of mortuary rituals are another example of burnt human bones which cannot be classified as cremation (Weitzel and McKenzie, 2008). Even today, forensic anthropologists frequently encounter burned human remains resulting from processes which could not be classified as cremation, such as accidents, disasters, and perpetrators attempting to destroy the bodies of murder victims (Fairgrieve, 2008).

Although cremation is often posed as the direct opposite of inhumation (Binford, 1971), cremation is often combined with other treatments. This might involve one or more of the following: divide the cremated remains between the mourners (Brück, 2004, 182), crush and scatter or consume the remains (Kaliff, 2007, 135), throw the remains into a body of water (Oestigaard, 2007, 32), bury the remains in a container (e.g. Shepherd and Shepherd, 2001) or bury the remains by covering the pyre site (e.g. Richards, 2004). Not all cremations leave recognisable signs in the archaeological record. Unless a pyre site is rapidly covered up by earth, any signs of burning will quickly disappear(Gräslund, 1978).

Just as not all burnt bones are the result of cremation, not all deliberately cremated remains represent burials. The act of cremation produces three types of archaeological features with cremated human remains: a pyre site, resulting from the act of cremation itself; a pit or pits with redeposited pyre debris, in other words the remains of the pyre, without the majority of the bones; and finally, the burial (Blaizot and Tranoy, 2005, 171). The importance of differentiating the different types becomes evident when considering demography, as the numbers of individuals on a site can be inflated if not only true burials, but also the pyre sites and any pits with redeposited pyre debris are counted (Blaizot and Tranoy, 2005; Wahl, 2008). Although distinguishing un-urned burials from pits containing redeposited pyre debris can be difficult, especially when there is poor preservation, this problem does not tend to be a problem when dealing with urned cremation burials.

1.4 A historical perspective on cremation in Europe

Fire played an important part in mortuary ritual in temperate Europe as far back as the Mid-Upper Paleolithic (c. 20,000-30,000 cal BP) (Pettitt, 2006). The earliest evidence of cremation in temperate Europe is much later, in the Mesolithic, when it seems to have been sporadically occurring in both Northern and Western Europe (Brinch Petersen and Meiklejohn, 2003). Cremation rose to prominence during the Bronze Age (Harding, 2000). It was practiced during the Iron Age (Fitzpatrick, 2000), as well as during the Early Historic period by groups that had not yet converted to Christianity, such as Vikings and early Anglo-Saxons (Richards, 2004). Conversion brought with it a radically different view on cremation, which was understood by Christians as a profanation of the body, and not compatible with Christianity (Davies and Mates, 2005b). The opposition to cremation within Christianity stem from the notion of the resurrection of the body, based on both the New Testament and the Code of Canon Law (Naji, 2005). In reality, the practicalities of Early Christian burial owed much to both Jewish (Newton, 2005) and contemporary Antique (Naji, 2005) practices, both of which included inhumation and specific burial grounds. Thus, the adherence to inhumation stemmed from both theological reasons as well as existing traditions.

In the early medieval period opinion seems to have been divided on whether cremation really made resurrection impossible (Naji, 2005). Because Christian martyrs were sometimes cremated, the Apologist Minucius Felix, writing in the third century, argued that God had the power to resurrect anyone, even if their remains had been burnt (Newton, 2005). Similar views were later expressed by Augustine (Naji, 2005). Inhumation remained the preferred burial practice throughout the Medieval and post-medieval period (Newton, 2005). The ban on cremation was only reinforced in relation to paganism, such as the Scandinavian expansion of the 8th century AD (Richards, 2004; Naji, 2005). The Church did not encounter cremation again until in the late nineteenth century, when it became an issue both within the context of missionary work in India (Newton, 2005, 108). In contrast to the Abrahamic faiths, cremation is firmly established in Asian religions such as Buddhism and Hinduism (Caixeiro, 2005; Crosby and Collett, 2005). Eventually, the colonial contact with Buddhists and Hindus practicing cremation contributed to a change in the perception of cremation in Europe (Parker Pearson, 1999a, 42).

Throughout the late 19th and early 20th centuries AD, cremation was reintroduced in most Western countries. Cremation was championed as a modern, rational and hygienic way of disposing of dead bodies, without taking up much space or spreading diseases (Davies and Mates, 2005b). The reintroduction was the result of the initiatives of organisations devoted to the cause. Many of the leading figures of these organisations were scientists (Davies and Mates, 2005b). Among these were archaeologists, who linked cremation to classical ideals. By depicting cremation as a sign of an advanced society, they helped promote cremation to an educated audience (Back-Danielsson, 2009). Cremation was eventually widely accepted, and is now more popular than inhumation in many parts of Europe (Davies and Mates, 2005a). The popularity cremation in the West still reflects the influences of Catholicism, Protestantism and Greek or Russian Orthodoxy. Cremation is common in traditionally Protestant regions, less common in regions that are traditionally Catholic and rare in traditionally Orthodox areas (Davies and Mates, 2005b). The Catholic Church did not officially allow cremation until 1963 (Newton, 2005), while the Orthodox churches are still to accept it (Boumis, 2005). The changing views on cremation in the west have influenced archaeologists' view of the rite, and vice versa (Back-Danielsson, 2009).

1.5 Reading the mortuary ritual

In trying to make sense out of the mortuary ritual, one is faced with a vexing question: why did the participants chose to do what they did? In other words, what did their actions mean to them? In his famous 'ladder of inference', Hawkes (1954, 162) placed ritual at the top, as the area of prehistoric human existence that was most difficult for archaeologists to understand. He argued that it was impossible to really know anything about the spiritual life of prehistoric people, as theories could never be proved beyond doubt. However, his argument is undermined by his paradoxical belief that some, to his mind, obvious inferences could be drawn, such as female figurines being related to fertility and Paleolithic cave art to hunting magic. In a polemic, Bell (2007, 283) countered the argument that archaeologists cannot study ancient ritual because they can never fully know what the rituals meant to the people of the past. Rituals, she suggested, can be analysed in many ways, not just by trying to explain the point of view the participants. She argued that, ironically, the participants of a ritual are often portrayed as knowing little about its actual meaning.

Indeed, when anthropologists study modern day ritual, questions of why things are done in a special way, or what a specific aspect means do not tend to produce useful answers. The informants may argue that it is the way that something has always been done, or they may use their imagination and speculate on matters that they themselves have often wondered about, offering little help to the outside observer (Parry, 1994, 2). When studying the Jain *puja*, or rite of worship, Humphrey and Laidlaw (1994, 140-141) found that only about a half of their informants could give them a clear account of the *puja*. Even these informants tended to go about the rite quite differently from their account when they actually performed it. A complete, sequential performance of the rite was rare, and only happened on special occasions, such as when teaching it to someone. This lead Humphrey and Laidlaw (1994, 264) to suggest that "[i]n thinking of symbolism as a code, anthropologists miss the fact that in offering interpretations of a ritual their informants are actually being creative".

Sometimes, how rituals are actually performed may even contradict the dogmas and teaching of the religion. One prominent example is that of Buddhism, in which the teachings of the Buddha specifically mentions that the dead body is of little consequence. Yet, the disposal of dead bodies is as ritualised amongst Buddhists as amongst other groups, and includes the veneration of relics, building burial monuments and various laborious forms of treating the dead, such as excarnation and mummification (McCorkle, 2010, chapter 2). These examples serve to emphasise that any perceived precise meaning of a ritual, and its supposed place within a system of thought can be highly complex, and not easily deciphered even when the people being studied are alive and available for questioning.

During the last decades, studies of ritual have moved away from approaches treating ritual as something to be deciphered, towards approaches that treat ritual as the result of special ways of acting and thinking. Both Bell (1992) and Humphrey and Laidlaw (1994) emphasised the role of the body in ritualisation. Bell (1992, 107-108) argued that one of the basic strategies of ritualisation was to create a ritualised social body. This, she claimed, constitutes a body that possesses a cultural sense of ritual, in other words, an embodied, rather than intellectual, sense of 'how things are done' in that specific cultural environment. Similarly, Humphrey and Laidlaw (1994, chapter 6) used Marcel Mauss' concept of 'body techniques'(Mauss, 1979), the way in which bodily movements, such as the way we walk or swim, are specific to particular societies, to discuss ritual. Using the example of the Jain *puja*, they argued that a ritual is made up of a number of body techniques, including specific ways of walking, sitting, bowing and so on. Even the smallest of acts within the ritual, such as placing a flower, or dipping the finger into sandalwood paste without wetting the fingernail, is done in particular ways, naturalised from an early age and difficult for an outsider to copy. What sets ritualised acts apart from other types of acts is what they called the 'ritual commitment', which they defined a specific mindset which en-ritualised any act (Humphrey and Laidlaw, 1994, 136). Further, Humphrey and Laidlaw (1994, 136) argued that ritualisation emphasised the wholeness of a series of acts constituting a ritual, rather than the acts in themselves. A ritual can contain both acts which are ritualised and those which are not. The act of placing the flower is ritualised, but stretching ones' limbs or yawning are not. Therefore, much of the tacit knowledge of what is going on is mentally filtered out. What these two approaches emphasise is the form of the ritual as a whole. The specific acts that add up to the ritual are important, rather than the content. They emphasise the feeling of taking part of a ritual, rather than the way in which the participants justify or interpret their actions.

Cognitive approaches suggest that human brains are programmed for ritual behaviour, an evolutionary trait that enforces social ritual as a way to channel personal fears and give structure to social life (Boyer and Liénard, 2006, 821). In the case of mortuary ritual, there are specific, ingrained behaviours at play. Mortuary ritual is set apart from other types of ritual in that it does not only involve a living human body, but also a dead one. Although archaeological interest in the body began already with post-processual archaeology, it had been of a very different nature. Traditional post-processual approaches tended to depict the dead body as little more than an object to be manipulated for ideological means (Sofaer, 2006, 19-20). In the following decades, more dynamic approaches have explored the role of the dead body, and the reactions of the mourners towards it. The special role of the corpse, a human body which is not quite a human any longer, but not really an object, either, has been highlighted by both cognitive and theoretical approaches.

McCorkle (2010, 100-102) argued that there was no scientific basis for claiming that the smell of decomposition from corpses triggered a 'biological warning system' in living human beings, causing them to behave with disgust towards human cadavers or places and objects associated with them. In other words, there was no evidence for suggesting that the ritualised behaviour towards corpses was based on an evolutionary sense of disgust, as compared to, for example, how rats and ants are triggered by specific molecules to remove dead individuals from their nests (Pinel et al., 1981). Instead, he argued that the need to perform ritualised actions is triggered by the activation of several mental systems tied to the Hazard-Precaution system (HPS), a complex mental system triggered to handle dangers, such as predation and contagion avoidance (McCorkle, 2010, 142-143).

Based on experimental results, Mccorkle argued that the HPS is much more complex than previously thought, and that it is mainly triggered by potential threats, rather than real threats, to human beings. According to McCorkle, human cadavers belong in the potential threats category, since scientific data indicate that they do not pose an imminent threat to human health. Instead, he claimed that "HPS is activated because a dead body violates multiple expectations about its ontological state (i.e., agents do not cease to be agents very easily once they are given this ontological status)' (McCorkle, 2010, 143).

This argument is very similar to those made in other disciplines to explain human and animal attitudes towards dead conspecifics. Animals such as bottlenose dolphins, elephants and chimpanzees have been observed to display various types of behaviours towards dead conspecifics, such as guarding or touching them (Douglas-Hamilton et al., 2006; Dudzinski et al., 2003; Stewart et al., 2012). Attempts to explain these behaviours in animals tend to focus on their ability to recognise the dead individual, as well as varying degrees of recognition of its changed state, from alive to not alive (e.g. Dudzinski et al., 2003). In humans, various theories make use of our tendency towards categorisation, and the confusion and/or fear experienced when presented with that which cannot easily be categorised.

One of the most famous examples is Mary Douglas' *Purity and Danger* (Douglas, 1966), in which she suggested that humans have a tendency to create binary categories to maintain a sense of order. Not everything fits into binary categorisation, and that which is out of place tends to be viewed as polluting or dangerous. Douglas (1966, chapter 7) explored the role of the human body in her discussion of margins and boundaries. To her, the human body was ripe with a symbolism that was emotive and easily conveyed, due to each individual's familiarity with their own body. She suggested that the body could be used as a model for any bounded system. The margins of the body, symbolised by its orifices, bodily fluids and waste, were dangerous. Death pollution, associated with the dead body, was related to this dangerous marginality.

In her study of Mesolithic burial, Nilsson Stutz (2005) made use of the abjection theory by feminist psychoanalyst and literary critic Julia Kristeva. To Kristeva (1982, 1-4), the abject was that which is neither subject nor object, but which falls in between. The abject, she argued, is familiar, but rejected. It is that which defies classification and disturbs order and system, and which is found uncanny and repulsive. Kristeva suggested that examples included criminals, which by their actions exposed the frailty of the law, or loathed foodstuffs, such as the skin on cooling milk, which children are expected to consume whether they want to or not. However, Kristeva viewed the corpse as the abject *par excellence*. The reason for this is because the corpse is the very embodiment of death, something loathsome and frightening that exposes the ugly, biological reality of death that is often denied, for example by describing the dead as merely sleeping. Interestingly, Nilsson Stutz (2005, 88-92) argued that archaeologists themselves share this horror of the corpse. This manifests through the twin tendencies to emphasise the culturally constructed body at the expense of the physical body, and to avoid the physicality and sensory impact of the dead body in the mortuary ritual. In her words, archaeologists have tended to filter out the "uncontrollable physical and biological aspects of death and preferred not to reflect on the dead body - in all it entails, through decomposition and decay. Instead we have preferred to talk of the clean skeletons in the ground and of living reconstructed societies' (Nilsson Stutz, 2005, 93).

The theories of Douglas (1966), Kristeva (1982) and McCorkle (2010), although coming from very different backgrounds and theoretical inclinations, ultimately present a similar argument. Corpses are dangerous and/or frightening because they defy classification. They are human beings, and yet they are not. According to Douglas (1966, 161-162) that which is out of place is dangerous as long as it retains some identity, and can still be recognised as what it once was. At the end of the process of decay and fragmentation, all identity will be lost, and the dangerous sense of ambiguity will no longer be evoked. At this stage, she argued, even human bones will cease to be frightening. It follows then that mortuary ritual aims to reclassify an individual from living to dead, to symbolically remove them from the world of the living. The reclassification from alive to dead involves separating the dead person's identity from the dead body (Nilsson Stutz, 2005, 95-98).

This very broad outline of what mortuary ritual is and what it does cannot on its own 'explain' the rituals surrounding Bronze Age urned cremation burials. Mortuary ritual is a universal feature of human beings (e.g. Hawkes, 1954; Parker Pearson, 1999a; McCorkle, 2010), going back at least 30,000 years (Pettitt, 2011, 267-269), and as such it displays an impressive range of variation. However, if mortuary ritual always aim for the same thing - the reclassification of an individual from living to dead - then it is not the overarching meaning of the particular mortuary ritual that needs to be explored, but its form. The osteological analysis performed on the cremated remains used for this research will provide the basis for reconstructing the sequence of the treatment of the bodies of the dead, which is central to the mortuary ritual.

1.6 Document structure

Chapter 2 contains the literature review. The first sections outline the study of mortuary ritual in social anthropology and archaeology, with a particular focus on approaches from the 1960s and onwards. Further sections reviews the sources used to reconstruct the process of cremation and how bodies burn on outdoor pyres.

Chapter 3 contains the temporal and geographical context to the study, the Scottish Bronze Age. The first sections defines the Bronze Age and outlines a history of Scottish Bronze Age research. The third section focuses on Bronze Age society in Scotland. The last section gives an outline of the various types of mortuary ritual of the Earlier and Later Bronze Age, including the different types of cremation and inhumation burial.

Chapter 4 describes the osteological material that was studied, and outlines the methods used for the osteological analysis, including the assessment of age, sex, stature, minimum number of individuals, pathology, whether an individual was cremated as a fresh corpse or as dry bones, temperature and efficiency of cremation, calcination patterns, staining and pyre goods.

The results are presented in Chapter 5. They are further discussed in Chapter 6, which sketches an outline of the mortuary ritual, based on what can be reconstructed from the cremated remains. A summary is offered in Chapter 7. The appendix contains the full report of the osteological analysis.

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Chapter 2

Mortuary ritual

2.1 Defining mortuary ritual

In order to define mortuary ritual, it is necessary to begin by defining ritual itself, a notoriously difficult task. Definitions have varied historically, reflecting the paradigms of the time and the theoretical inclinations of scholars. Theories explaining ritual can be broadly divided into two groups, one which holds that rituals are about meaning, expressing world views and being closely linked to religious belief, and one which emphasises outer form, viewing rituals as performances shaped by rules (Bradley, 2005b, 32).

Although early theorists such as Tylor (1871) and Frazer (1915) as well as some more recent scholars, such as Rappaport (1999) adhered to the earlier group, it is the latter which has long dominated anthropological thought. Its roots go back to theories outlined by Durkheim (1915). He suggested that what he termed 'primitive people' did not have a distinction between natural and supernatural, but rather between sacred and profane. Ritual and religion concerned itself with the sacred, that which was set apart, superior and worthy of respect. Later, functionalists such as Radcliffe-Brown (1952, 142-143) emphasised the symbolic nature of ritual acts, differentiating it from technological ones. Other anthropologists would further define ritual as prescribed, formal, and without technological consequences (Leach, 1964). Such definitions cemented the perception of ritual as form rather than substance, and as something separate from other spheres of life.

However, anthropology has increasingly moved away from very broad definitions of ritual (Brück, 1999, 315). The use of the term ritual, which peaked in popularity in the anthropology of the 1960s to 1980s, decreased during the 1990s, perhaps because the term had become too general (Bradley, 2005b, 30-32). Two works published in the early 1990s had a profound influence on modern anthropological thought: Catherine Bell's *Ritual Theory, Ritual Practice* (Bell, 1992), and Caroline Humphrey's and James Laidlaw's *The Archetypal Actions of Ritual* (Humphrey and Laidlaw, 1994). Although both emphasised structure rather than meaning, they opposed the notion that ritual was a separate sphere of activity. Both works favoured the term ritualisation, focusing on how ritual was created in the minds and bodies of the people involved in a ritual. Bell (1992) saw ritualisation as the way in which an action becomes ritual through the active participation of the people taking part in it. Similarly, Humphrey and Laidlaw (1994) argued that ritual was inherently meaningless, and that it was the structure and the correct way of performing the ritual, which was of importance. In the 1990s and onwards, cognitive anthropologists have studied ritual behaviour, a concept close to ritualisation. Boyer and Liénard (2006, 815) defined ritual behaviour as being compulsive, rigid, redundant (meaning that the same acts are often repeated within the ritual), and goal demoted (in that the actions are not directly linked to their purported goals).

Reminiscent of how Freud (1957) likened religious observance to the obsessive behaviour of neurotics, Fiske and Haslam (1997) explored the similarities between cases of obsessive compulsive disorder (OCD) and ritual sequences, showing that the same patterns occurred in both domains. In cognitive models, humans are hard-wired to engage in social rituals, a trait that has evolved to channel personal fears and make social life easier and more structured, but which can sometimes become pathological (Boyer and Liénard, 2006, 820-821). Like the models of Bell and of Humphrey and Laidlaw, these models suggest that human beings create ritual through thinking and acting in particular ways.

Archaeologists face other problems than anthropologists when studying and defining ritual. The main problem is how to identify ritual in the archaeological record. On the one hand, it has been argued that archaeologists have simply tended to identify anything that does not appear functional or logical as ritual

(Brück, 1999; Bradley, 2005b). On the other hand, as seen in contributions to volumes such as *The archaeology of Ritual* (Kyriakidis, 2007), archaeologists have spent much energy in trying to establish a useful working definition of ritual, in order to be able to identify it archaeologically. Bell (2007, 277-278) questioned archaeologists' need for more narrow definitions, in light of the incomplete nature of the archaeological record. Interestingly, she argued that in the case of archaeology, the simplest definition, that rituals were activities addressing the gods or other supernatural forces, was the most useful.

This takes us back to mortuary ritual, and the privileged position that it holds compared to other types of ritual. Crucially, the ritual nature of the disposal of the dead is never questioned. It is automatically held to be ritual (Hawkes, 1954; Parker Pearson, 1999a; McCorkle, 2010). This means that the question of when mortuary ritual evolved has received much attention, as its presence is used as a proxy for other, less tangible developments, such as language and other aspects of symbolic thought (e.g. Mithen, 1996; Pettitt, 2011). In contrast to humans, most animals appear to show limited interest in their dead conspecifics (Douglas-Hamilton et al., 2006, 88), as long as the dead do not threaten the health of the surviving individuals. It has been shown that both ants and rats are triggered into removing dead individuals from their nests by the presence of polyamines such as cadaverine, which result from putrefaction (Pinel et al., 1981). The reactions of more intelligent animals, including dolphins, elephants and chimpanzees are more complex, going beyond a basic triggered response. Bottlenose dolphins have been observed guarding and scanning dead conspecifics. The living individuals did not attempt to lift the dead individual to the surface, which would have been a natural reaction had they believed it to be alive. It was thought that the living dolphins communicated between each other in reference to the dead individual (Dudzinski et al., 2003). Similarly, elephants have been observed guarding and interacting with the bodies of their dead conspecifics. After the death of the matriarch of a herd, Douglas-Hamilton et al. (2006) observed females of the matriarch's own family as well as females of other family groups standing by the body and occasionally touching it, up until a week after the death had occurred.

There is a significant body of observations of chimpanzees reacting to a death in their community (Pettitt, 2011, chapter 2). Observers have reported a variety of different reactions, such as touching the dead body in both aggressive and non-aggressive ways, making different noises or simply standing around it. Stewart et al. (2012) suggested that the reaction of individual chimpanzees towards a dead community member varied between individuals of different ages and sexes, as well as based on individual experience. Chimpanzees seem to have an awareness of death, as their responses towards a recently deceased chimpanzee is different to that towards a dying one. Pettitt (2011, 38-40) used data from chimpanzees to develop a model of early hominid morbidity and mortuary activity. He suggested that the core elements present when dealing with a corpse would have been what he terms cronos compulsions, such as infanticide and cannibalism; morbidity, including touching and grooming the corpse; mourning, including signs of depression, and carrying the corpse; and finally social theatre, involving controlled access to the corpse and displays including gatherings. Importantly, this core behaviour, like that of other non-human animals, was not yet connected to symbolic and abstract ways of thinking. It can therefore not be classified as mortuary ritual.

Ritual behaviour, expressed in the archaeological record as widespread traditions of formal burial with grave goods, would have necessitated verbal communication to express beliefs and share these beliefs with others. Such a stage was reached by both anatomically modern humans and Neanderthals by the Mid-Upper Palaeolithic (Parker Pearson, 1999a, 149), with elements of symbolism in the mortuary ritual probably dating back to c. 100,000 BP and fully symbolic behaviour from c. 30,000 BP (Pettitt, 2011, 267-269). After c. 30,000 BP, a tradition of formal burial is evident, with over 50 burials identified belonging to the Gravettian-Pavlovian/Willendorfian-Kostenki/Avdeevo technocomplex (GPWKA), which stretches from Siberia to Britain. The small number of burials indicates that it was a rare occurrence, but the similarities in the burials suggests a shared tradition (Pettitt, 2006). The emergence of cemeteries is a feature of the end of the Palaeolithic, coinciding with the first complex hunter-gatherers and increased sedentism, a trend that continues into the Mesolithic and beyond (Pettitt, 2011, 259). The Mesolithic/Epipalaeolithic also sees the beginnings of monumentality in the Near East (Parker Pearson, 1999a, 158-159).

2.2 Mortuary ritual in social anthropology

Traditionally, the study of religion, and by extension ritual, was confined to theology. However, the second half of the nineteenth century saw changes to Western culture which challenged the privileged position of Christianity (Pals, 1996, 3). One of the milestones in the study of religion was the publication of Max Müller's *Introduction to a Science of Religion*, based on a series of lectures given in 1870. Müller (1873) argued that religions could and should be objectively studied and compared in order to gain a deeper understanding of specific religions, and of religion itself, just as comparative philologists studied language. Early anthropologists Edward Burnett Tylor and James Frazer devoted some energy to the question of religion; Tylor in the second volume of his *Primitive Culture* (Tylor, 1871), and Frazer in the twelve volumes of his *The Golden Bough* (Frazer, 1915). Both Tylor and Frazer were mainly interested in the origin and evolution of religion. In their schemes, rituals were mainly of interest for being remnants of past customs, rather than having a meaning in and of themselves (Metcalf and Huntington, 1991, 30-31).

A milestone in the sociology and anthropology of religion was Emile Durkheim's *The Elementary Forms of the Religious Life* (Durkheim, 1915), originally published in 1912 and translated into English in 1915. In contrast to earlier theories, Durkheim argued that religion was not about deities or the supernatural, but rather about the divide between the sacred and the profane. The sacred was that which was superior, powerful and deserving of respect; larger concerns involving the whole of society, whereas the profane was the opposite, the small, private matters of routine and everyday life. Therefore, according to Durkheim (1915, 47), religion was 'a unified system of beliefs and practices relative to sacred things, that is to say, things set apart and forbidden'. Exploring rituals in the context of Aboriginal totemism, he divided the rituals into three categories: positive cult, negative cult and what he termed piacular rites. The role of the negative cult was to keep the sacred separate from the profane through prohibitions and taboos (Durkheim, 1915, 299). In contrast, the role of the positive cult was to enter into the realm of the sacred (Durkheim, 1915, 326). Piacular rites were rites of atonement and mourning, and took place after a death, or other tragic event. The role of these rites was to heal the rift in society after a death, a way for society to regroup and reaffirm itself (Durkheim, 1915, 389). Although Durkheim's uncritical use of sources, and misconceptions about Aboriginal religion were to become criticised (Evans-Pritchard, 1968), his model for understanding mortuary ritual was highly influential (Seremetakis, 1991, 12-13).

A later generation of anthropologists, working in the first half of the twentieth century, rejected the focus on evolution that had characterised the work of early theorists. They viewed societies within a functionalist framework, focusing on how societies functioned in the here and now, rather than in a historic perspective. Functionalists understood societies as consisting of different systems, such as religion, kinship, economics and so on. These systems were interdependent, much like the different systems of a living organism (Barnard, 2000, 62-63). Within such a framework, mortuary rituals were understood based on their perceived function for society as a whole, rather than any meaning derived from it by the individuals involved (Parker Pearson, 1999a, 22-23), similar to the role of Durkheim's piacular rites. In his classic study of the Andaman islanders, Radcliffe-Brown (1922, 324-328) emphasised the collective nature of ritual, and how the rules and customs of the rituals dictated the correct manner for individuals to behave in times of stress, including funerals. He saw rituals as crucial in keeping the social system alive and managing the Andaman islanders' fears, especially of the spirits of the dead. Similarly, Malinowski (1948, 34-35) explained mortuary rituals in what he termed 'primitive societies' as a way of controlling and channeling the individual's fear of death and of the corpse. Without it, the bereaved would not be able to cope, and their society would disintegrate.

The structuralist view of mortuary ritual was later criticised by Geertz (1973). Using an example from his own fieldwork in Java, the death and burial of a ten-year old boy, he described how mortuary ritual could cause division and increase tension, rather than the opposite. After the death of the boy, tensions between different political and religious factions meant that the boy was initially denied the customary rituals. The confusion caused by this unexpected refusal, and the eventual improvised rituals, lead to unease and emotional behaviour which would normally be inappropriate at a Javanese burial. Geertz classed this as a case of a ritual failing its purpose (Geertz, 1973, 163). In discussing this example, Bell (1992, 33-34) argued that Geertz had wanted to argue for the role of ritual in cultural change, but that he was prevented by his own assertion that this was a failed, and therefore atypical, ritual.

In 1960, two works which would become highly influential for the understanding of mortuary ritual were translated from French. Although both had originally been published in the first decade of the twentieth century, their full impact was felt after their translation into English. The first was Robert Hertz's essay *The collective representations of death* (Hertz, 1960), originally published in 1907. The second was Arnold van Gennep's *The Rites of Passage*, originally published in 1908 (van Gennep, 1960). Neither of these works were based on original fieldwork. While Hertz's model built on ethnographic data of various groups in Indonesia, van Gennep's was based on a wider, cross-cultural sample. Hertz's focus lay solely on mortuary ritual, while van Gennep's concept of rites of passage built upon a variety of different types of ritual, but in many ways, the theories they proposed are similar and complimentary.

Hertz (1960) wrote about societies practicing so-called double burial, in which the corpse is temporarily buried or kept in one place until most or all of the flesh has vanished, at which point it is buried permanently. He proposed that, unlike in the West, societies practicing double burial viewed death not as something happening in an instant, but as a gradual process, in which the state of body and soul mirrored each other. The transition of the soul was only complete when the physical body was destroyed. The period of transition, while the flesh was decomposing, was a dangerous and polluting one, during which the soul of the dead was neither in this world nor the other. During this period the mourners were also outside normal society, being seen as tainted or polluted by death. With final burial, the soul could move on and the mourners be reintegrated into society. Hertz emphasised how in such societies, the passage of an individual through different stages was seen as a series of deaths and rebirths. Physiological death was only one such occurrence (Hertz, 1960, 81).

van Gennep (1960) coined the term 'rites of passage' to describe rituals which he claimed existed in all societies. Similar to Hertz, van Gennep claimed that individuals passed through different stages in life. He demonstrated that the passing from one stage to another was often accompanied by specific rites; rites of passage. These could be divided into three parts. The first part was the preliminal rite, which served to separate the individual from the existing, everyday world. The second part was the liminal one, which took place during the transitional stage, when the individual was neither in one social state nor the other, and thus outside of the normal social order. The third part was the postliminal rite, which re-admitted the individual into society and incorporated them into their new social state (van Gennep, 1960, 21). van Gennep (1960, 146) noted that one of the peculiarities of mortuary ritual was that the liminal or transition rites were the most important part of them, being so long and elaborate as to stand apart from the preliminal and postliminal rites.

The work of van Gennep (1960) on the rites of passage influenced several anthropologists working on ritual, among them Mary Douglas (Douglas, 1966), Victor Turner (Turner, 1969) and Edmund Leach (Leach, 1976). Turner and Leach both elaborated the original model suggested by van Gennep, thereby helping to popularise it. Importantly, Turner (1969) further developed the concept of the liminal stage by identifying the attributes of liminality and liminal entities, which he described as betwixt and between, being neither in one state nor the other, and frequently likened to death. Although his work focused on initiation rituals, the concept of liminality became an important one for understanding mortuary ritual (Metcalf and Huntington, 1991, 33-34), as the corpse, and frequently the mourners, are seen as liminal. Similarly, Douglas' work on purity and pollution, in which she discussed the importance of categorisation in human societies, expands the notion of liminality. Douglas (1966, 4-5) argued that it is only by exaggerating differences in order to create binary categories that humans manage to create a sense of order. That which falls in between, or which ends up out of place, is seen as dangerous. The transitional phase of a ritual was considered dangerous, as it belonged to neither one state nor the other. For this reason, the individuals in this stage are perceived as dangerous or polluting (Douglas, 1966, 96-98). Although both Hertz's and van Gennep's models are now seen as vague truisms (Metcalf and Huntington, 1991, 112), their influence should not be underestimated. The symbolic potential of the corpse, as well as its liminality - the way in which it is both human and not - are still relevant to studies of mortuary ritual (Nilsson Stutz, 2005, 95).

Other anthropologists would go on to study further symbolic aspects of mortuary ritual. The observation that funerals often referred back to fertility and regeneration was made already by early theorists such as Frazer (1915). Metcalf and Huntington (1991, 108) (first edition 1979) suggested that the symbolism of mortuary rituals tend to be focused on the continuity of life, and for this reason themes of sexuality and fertility were often the dominating ones. The link between death and fertility was taken up by Bloch and Parry (1982a), in their *Death and the Regeneration of Life*, a highly influential collection of essays exploring the use of sexual and fertility symbolism in mortuary rituals. In the introduction, they argued that the earlier assumption that sexual symbolism expressed in mortuary rites had to be a symbolic regeneration of life, was wrong. Instead, they pointed to how sexuality, especially female, is often seen as the ultimate cause of death, such as in the Judaeo-Christian tradition of the expulsion from paradise. Instead, they suggested that sexuality was invoked in mortuary rituals as something that had to be overcome in order to triumph over death (Bloch and Parry, 1982b, 18-20), a controversial statement which was criticised by other anthropologists (Metcalf and Huntington, 1991, 7-8).

The 1980s and 1990s saw further influence from post-modernism, post-colonialism and relativism, emphasising local perspectives as well as issues of class and gender. A prominent example within the field of mortuary ritual was C. Nadia Seremetakis' *The Last Word: women, death, and divination in Inner Mani* (Seremetakis, 1991). Her ethnography belongs within a larger tradition of feminist ethnographies written by women with links to the culture they were describing, providing intimate insights into groups which might otherwise refuse access to anthropologists, and blurring the line between the observer and the observed (Visweswaran, 1997, 613). Seremetakis studied the role of women in mourning in Inner Mani, a rural area of Greece. She opposed the divide between individual mourning and ritualised collective mourning which she argued had loomed large in anthropological notion of mortuary ritual since the days of Durkheim, and which only served to preserve the notion of death as a component of an overarching social organisation. By reducing death to kinship, inheritance, social power of men, and so on, she claimed that death became merely a stage for a variety of social dramas, doing little to further the understanding of these rituals (Seremetakis, 1991, 13-14). Instead, she suggested that mortuary rituals should be studied as 'integrities with their own temporal rhythms, transformations, and levels of engagement and disengagement from the social order '(Seremetakis, 1991, 15).

The last decades have seen a growth in cognitive anthropological approaches to ritual and religion (e.g. Mithen, 1996; Boyer, 2001; Boyer and Liénard, 2006). An influential cognitive anthropological approach to mortuary ritual is found in the work of McCorkle (2010), as outlined in his *Ritualizing the Disposal of the Deceased: from corpse to concept*. McCorkle took as his cue the contradiction between how Buddhist doctrines regarding dead bodies, and how these bodies are actually treated by Buddhists. Buddhist doctrine decrees that the dead body is unimportant, making the ritualised disposal of it the height of superstition. But Buddhists do, in fact, engage in special handling of the dead, including building burial monuments, making sacrifices to the dead and worshiping relics (McCorkle, 2010, 42-43). Based on this contradiction, McCorkle explored the cognitive science behind why humans should behave so counterintuitively. He suggested that the ritualised disposal of dead bodies had to have an evolutionary reason, or it would not be so widespread, and so persistent. He proposed that the reason was not that corpses pose a biological threat to the living, but as by-products of mental systems evolved in humans in order to deal with the living and process complex social arrangements (McCorkle, 2010, 102-103).

2.3 Mortuary ritual in archaeology

In contrast to anthropology, graves are of central importance for archaeology. Indeed, for some periods, such as the Neolithic and Early Bronze Age, burials were once the main source of information (Chapman and Randsborg, 1981, 3). Despite this, mortuary ritual and mortuary practices were rarely theorised by archaeologists before the second half of the twentieth century. In general, variation in burial patterns, such as different treatment of the body and variations in burial monuments or grave goods, were simply seen as representing different people or cultures (e.g. Montelius, 1885; Childe, 1925). Interpretations of ritual tended to be limited to simplistic assumptions, such as assuming that any grave goods represented objects and foodstuffs which could be of use to the dead person in the next world, an idea which had been put forward by Tylor (1871, 483-96). Influential prehistorians had little interest in ritual. Some believed it to be unimportant (Bradley, 2005b, 193). Others doubted that it could be meaningfully reconstructed. In his famous 'ladder of inference', Hawkes (1954, 162) placed ritual at the top, as the area of prehistoric human existence that was most difficult to reconstruct for the archaeologist. He considered ritual and belief to be so far removed from the material remains found in the archaeological record as to be beyond the grasp of archaeologists. Human remains were often overlooked by traditional archaeologists, or used for discussions about race and origins, rather than any aspect of the mortuary ritual (Gowland and Knüsel, 2006a).

In the 1960s, a new generation of archaeologists began to question earlier views on what archaeology was and what it should be. They argued that instead of describing and cataloguing artefacts, archaeologists should interpret and reconstruct past lifeways using the archaeological record. A key concept of what would be known as processual archaeology was the middle range theory, cross-cultural laws to link human behaviour to the archaeological record (Raab and Goodyear, 1984). Some of the seminal works of processual archaeology were devoted to the interpretation of graves using ethnographic records for comparison (Sofaer, 2006, 16).

Saxe (1971) set out to test eight cross-cultural hypotheses about the relationship between mortuary practices and social systems using ethnographic records from the Ashanti of West Africa, the Kapauku of New Guinea and the Bontoc Igorot of the Philippines. The enduring legacy of Saxe's thesis was his Hypothesis 8. It stated that formal disposal areas for the dead (cemeteries) were used by social groups to legitimise their rights over crucial resources using their ties to the ancestors. Hypothesis 8 was later tested by Goldstein (1976), using further ethnographic examples. Her results suggested a more nuanced picture than that Saxe described, and added to the interest in the hypothesis, since then often referred to as the Saxe-Goldstein hypothesis (Rakita and Buikstra, 2005b, 4). The influence of the Saxe-Goldstein hypothesis is unquestionable; it has been tested, discussed and criticised in a number of works (Hodder, 1982b; Charles and Buikstra, 1983; Morris, 1991; Carr, 1995), and continues to influence cemetery studies in North America (Ashmore and Geller, 2005, 81).

Another important early contribution to the study of mortuary ritual by processual archaeology was *Approaches to the Social Dimensions of Mortuary Practices*, based on a conference held in 1966 (Brown, 1971). In the most famous of the papers, Binford (1971) explored reasons for mortuary variability, an umbrella term covering variations in the treatment of the body, grave goods and nature of the grave. He argued that while most earlier studies explained any variation based on vague notions about religious ideas, researchers should be looking at social complexity instead. Using ethnographic records of 42 traditional societies from the Human Relations Area Files collections, Binford compared social complexity, for which he used subsistence production as a proxy, to dimensions of the social persona, including sex, age and social position. He concluded that the variation seen in the archaeological record was correlated to the social rank of the dead individual and the number of people with relationships to the deceased. Additionally, more complex societies (sedentary farmers rather than hunter-gatherers or pastoralists) also appeared to have more complex mortuary practices, such as secondary burial.

Scientific methods were at the core of processual archaeology, and some of the attempts to formulate hard-and-fast rules which would explain the archaeological record were expressed as mathematical models. Tainter (1977) used statistical methods for understanding patterns in mortuary variability in terms of social structure and social organisation. He suggested that in death, individuals of a higher rank would be awarded treatments demonstrating higher energy expenditure, such as larger graves or elaborate grave goods (Tainter, 1975, 2). In such a way, sets of burials with similar treatments could be identified. These would then serve to interpret and classify the social system, which could be represented numerically based on their level of social differentiation. Apart from the obvious problem in suggesting that societies can be reduced to numbers (Parker Pearson, 1999a, 75), Braun (1981, 402-407) criticised the subjectivity of Tainter's model. He pointed out that the ranking of various mortuary treatments was poorly explained, and the problematic interpretation of the energy expenditure in producing certain artefacts included in the grave goods.

Although largely a North American phenomenon to begin with, processualism would also come to influence archaeology on the other side of the Atlantic. In 1981, *The Archaeology of Death* (Chapman et al., 1981) was published, with contributions from both European and North American archaeologists. It represented a more mature version of processual archaeology. In the introduction, the editors acknowledged the newer theoretical influences which were starting to affect the anthropology of death, most notably in Metcalf and Huntington (1979), which suggested that mortuary rituals were not only about asserting social persona, but about challenging and reforming them (Chapman and Randsborg, 1981, 14). Processual archaeologists were not interested in ritual per se, but rather social structure and aspects of the social persona, such as rank, which was interpreted as a reflection of what it had been in life. What this meant was effectively a de-ritualising of death, as seen in the way Binford (1971) rejected belief as a factor in explaining mortuary variability. Similarly, in the introduction to *Palaeoeconomy*, Jarman and Higgs (1975, 1) famously argued that the soul leaves no skeleton, in other words that beliefs and religion were something intangible, impossible to recreate from the archaeological record.

Archaeology generally adopts theories from other disciplines (Bradley, 2005b, 30-31), and in the late 1970s and early 1980s, some archaeologists were taking their cue from anthropology, such as the work of Geertz (1973) and newer studies of mortuary ritual (e.g. Metcalf and Huntington, 1979; Bloch and Parry, 1982a). The shift was away from general principles, towards a focus on detail, including such things as meaning and individual agency (Bradley, 2005b, 193). Early criticisms of processual approaches argued against the view of burials as mirroring rank and social relations such as they had been in life. Instead, they suggested, burials were lively and contested events, in which social relations and identities were manipulated and recreated (Parker Pearson, 1999a, 84-85).

In 1982 *Symbolic and Structural Archaeology* (Hodder, 1982a) was published. Although it was not a volume solely dedicated to mortuary archaeology, it contained two widely cited papers which criticised processual approaches to mortuary studies. Parker Pearson (1982, 105) analysed modern burials in Cambridge, comparing the expenditure on the burial with the wealth of the deceased. He found that the cost of funerals was not an indication of social position, as groups considered to have low social positions, such as gypsies or showpeople, tended to have lavish funerals. His findings contradicted the notions of processual archaeology, which suggested that high expenditure on burial equaled high status. Shanks and Tilley (1982) discussed the megalithic phenomenon of Middle Neolithic Europe, and presented a theory based on the reinterpretation of mortuary ritual in two regions of north-western Europe: Scania in southern Sweden and Wessex and the Cotswolds in southern England. The concept of ideology, the Marxist notion of the ruling class promoting their interests as the interests of the entire society, was central to Shanks and Tilley's theory. Ritual, especially mortuary ritual, was part of ideology, and used to maintain the social order. When the disarticulated bones of the dead were placed inside the megalithic tombs, the equality of the mortuary rite was a way of hiding inequality in life. Similarly, the work of Hodder (1984) emphasised how mortuary ritual and the building of megaliths were just one part of an ideological strategy through which certain groups could control crucial resources.

Arguably, many of these early post-processual works lacked enough ethnographic material to back up their hypotheses (Taffinder, 1998, 52-55), making their theories unconvincing, except in well-documented historical cases (Rakita and Buikstra, 2005b, 7). More importantly, later archaeologists would oppose the narrow focus on burials as occasions for manipulation, power play and struggle for dominance which characterised early post-processual approaches to mortuary ritual. Some argued that it offered, at best, a partial interpretation, reducing beliefs into something invented with the sole reason of misleading and subjugating others (Scarre, 1998, 182). The personal and emotional, as well as the agency of the individual, were issues which were brought to the fore. Tarlow (1997) argued that early post-processual approaches ignored what burials were mainly about: expressions of personal grief and loss. Using the example of changes to burial and commemoration from the Victorian era through to the First World War, she emphasised the lived experience of death and mourning, and suggested that it was impossible to consider death and the rituals surrounding it without touching on the emotions which shaped human response to death

(Tarlow, 1992, 1997).

In the 1990s a wider variety of approaches to the study of burials emerged. Notable examples were gendered approaches (e.g. Arnold and Wicker, 2000), cognitive approaches (e.g. Pettitt, 2011) and theories focusing on embodiment (e.g. Boric and Robb, 2008; Rebay-Salisbury et al., 2010). Two trends are important for the topic of this thesis: the incorporation of osteoarchaeological findings, and the increased theorisation of cremation.

Osteology was long underused in studies of past understandings of mortuary ritual (Nilsson Stutz, 2005; Gowland and Knüsel, 2006a; Sofaer, 2006). Before the 1960s, findings on human remains were often relegated to the appendices (Gowland and Knüsel, 2006a, ix-x). Even during processual archaeology, with its strong emphasis on mortuary contexts, osteological findings were merely used to assign age and sex, so that artefacts could be linked to individuals, which could then be classified in terms of status and fit into models of social organisation (Sofaer, 2006, 14-16). Post-processual archaeology addressed the body, but had a tendency to focus on the culturally constructed rather than the physical (Nilsson Stutz, 2005, 88), despite the fact that it still needed age and sex determinations of actual human remains to associate the body with material culture (Sofaer, 2006, 20). There is still a divide in archaeology between the more scientific branches of archaeology and the more theoretical, interpretative approaches (Gowland and Knüsel, 2006a). There are few osteoarchaeological studies that have successfully bridged this gap (Sofaer, 2006, 24), although studies of mortuary ritual clearly have the potential to do so (Nilsson Stutz, 2005, 67).

Because the dead body is the focus of the mortuary ritual, reconstructing as much as possible about how the body was handled by the mourners is of great importance (Nilsson Stutz, 2005, 81). Detailed attention to what happened to a body after death is traditionally more associated with forensic anthropology, where the post-mortem interval is an important concept (Haglund and Sorg, 1997). The better preservation seen in modern forensic cases makes it possible for forensic anthropologists to reconstruct more about what happened to an individual than in archaeological cases. Nevertheless, detailed forensic methods have been used successfully to reconstruct the last moments and postmortem fate of medieval battle victims dumped in mass graves (e.g. Kjellström, 2005; Mitchell et al., 2006; Fiorato et al., 2007), showing that detailed studies can give us important insights into the handling of dead bodies.

A branch of osteoarchaeology that has been used to study mortuary treatment in some detail is the French *anthropologie de terrain* or archaeothanatology (Duday, 2006, 2009). The methods involve detailed recording during the excavation of unburnt skeletons. The positions of different groups of bones are then interpreted based on knowledge about the order in which different soft tissues, particularly muscles and tendons, decompose. These interpretations can, in turn, be used to reconstruct the mortuary treatment, such as the state of the body when buried and the type of container, if any, was used for burial. One of the pioneering examples of fusing the anthropologie de terrain approach with ritual theory was the work of Nilsson Stutz (2005). Studying photographs of the burials of the Mesolithic cemeteries of Vedbæk-bøgebakken, Denmark and Skateholm, Sweden, she attempted to reconstruct the taphonomy of the bodies, including whether they had decomposed in rigid containers (coffin-like structures) or directly in the soil and whether they had been buried whilst relatively fresh.

Another important development in the last two decades is that cremation has received more attention from archaeologists (Williams, 2008). This has resulted in an increased theorisation of cremation as a mortuary ritual, including exploring its symbolism and meaning. Two broad themes can be discerned in these theories: one that focuses on the body and identity, and one that explores the link and shared meaning between cremation and pyrotechnologies, especially metal production.

The notion of a body/soul dichotomy, meaning that the soul is seen as something separate from the physical body, traditionally dominated the view of past cremation (Richards, 2004; Rebay-Salisbury and Stig Sørensen, 2008a). In these narratives, cremation was reduced to a way to set the soul free by destroying the polluting or unimportant body (Stig Sørensen, 2010, 59). In studies of the Bronze Age, these views were supported by the use of ethnographic and ethnohistorical parallels, especially Hindu and ancient Greek cremation (Rebay-Salisbury and Stig Sørensen, 2008a, 141). Hindu cremation has proven especially popular for comparison in studies of the Scandinavian Bronze- and Iron Ages (e.g. Oestigaard, 2000, 2007; Kaliff, 2007). For Early Historic cremation, such as Anglo-Saxon and Scandinavian cremation, written sources seem to support the idea of cremation as a way of releasing the soul (Richards, 2004, 96-97). The idea of a soul as something separate from the body fits well with the modern, Western understanding of the body. But to assume that destroying the body and freeing the soul is the only purpose and underlying meaning of cremation has, arguably, limited the understanding of past mortuary ritual and prevented the further exploration of cremation and its meanings within the societies in which it was practiced (Richards, 2004, 96).

The notion that past societies would not necessarily have shared the modern, Western understanding of the body has been increasingly explored by archaeologists (Hamilakis et al., 2002; Boric and Robb, 2008; Rebay-Salisbury et al., 2010). Newer archaeological approaches have highlighted how the human body is manipulated, in life as well as in death (Sofaer, 2006; Gowland and Knüsel, 2006b; Rebay-Salisbury et al., 2010). In such a framework, cremation can be understood as a process of deconstruction through the use of fire, followed by reconstruction as the bones are collected and placed in a container (Ditlef Fredriksen, 2006, 133). This was possible, it is argued, because certain societies do not see human beings as individuals or bounded entities, but as 'dividuals', which can be divided or mixed (Brück, 2004; Goldhahn, 2009). Brück (2004, 180-183) discussed the variation in mortuary ritual in Early Bronze Age Scotland, suggesting that the increase of cremation indicated 'changing concepts of the self'. In her opinion, human beings were not perceived in the same way in the Bronze Age as in the modern day. The body was seen as something that could be divided and fragmented, and this showed up in the mortuary ritual.

Using examples from the Early Bronze Age of Central and Northern Europe, Stig Sørensen (2010) indicated that notions of the body differed between these areas and Britain. Whereas the human body was seen as dividual in Britain, this was not the case in Central and Northern Europe. Despite the extensive fragmentation that resulted from cremation, much energy was devoted to present the remains as a whole body. This was achieved through the presentation of cremated remains in the grave, which included strewing the cremated remains in an anatomical position and placing grave goods where it would have been placed on an unburnt body. Stig Sørensen (2010) suggested that early cremation burials were ambiguous, as if people's notion of the body were deeply rooted and resisted the change in mortuary treatment. The notion that a body was a composite whole consisting of its separate parts remained, even though the body was now cremated.

A contrasting opinion on Scandinavian Early/Middle Bronze Age cremation burials was given by Goldhahn (2009), who based his discussion on one of the graves used by Stig Sørensen (2010), the Danish Hvidegård grave. Whilst Stig Sørensen (2010) focused on how cremated remains were placed into a cist and arranged to resemble an unburnt body, Goldhahn (2009, 97-99) pointed out that the remains belonged to three people. Going on to discuss similar cases in which one person had been buried with parts of a second person, he argued that the mixing of two or more different individuals was seen as creating a new person Goldhahn (2009, 103). A similar interpretation was proposed by Williams (2001). He suggested that the large quantities of animal bone found in Anglo-Saxon cremation burials were purposeful inclusions. In his interpretation, cremation symbolised transformation, an opportunity to destroy and rebuild identity. The animals were perceived as parts of the new identities of the dead, in which human and non-human elements and qualities merged. Such ideas are supported by studies of the animal art of the period, in which human and animals elements mixed and merged. From these examples, it is evident that it was not only the cremation in and of itself which was symbolically important. It has been argued that the cinerary urn was deeply meaningful. Examples from continental Europe show both house-shaped urns and urns with faces (Sabatini, 2007). Rebay-Salisbury and Stig Sørensen (2008b, 61) suggested that the urn was a way protecting and enclosing the body, which had been made vulnerable and exposed by the cremation process. The walls of the urn gave the cremated person boundaries, and acted as a new skin.

As cremation involves a transformation of the human body using fire, its symbolic link to other such transformations has been explored. Pyre cremation would have involved a dramatic transformation of the deceased. The mourners would have been able to see the dead person change from a recognisable individual to bone fragments, no longer identifiable as a human being. This transformation involved knowledge of technical, hands-on aspects as well as purely ritual elements. A pyre had to be properly constructed to support a body, and include enough fuel to burn the body and any pyre goods. The fire had to get going, which to some extent meant that there had to be favourable weather as too strong winds or rain could extinguish the pyre. As the body burned, the fire might need to be tended, so that it would not die out. Williams (2004, 273) proposed that the knowledge of other pyrotechnologies would have helped people in the past understand the technology and meaning of cremation. At the same time, cremation would have been a dramatically different event than everyday technologies, due to the large scale and spectacle inherent. A further difference was the unpredictability of the cremation ritual, as every cremation was a different, individual event.

The metaphorical associations of metalworking were closely linked to its transformative nature, which made it easy to compare and contrast to other such transformative acts which employed a similar technology. Thus, Barber (2003, 173) argued, it is not strange that cremation rose to prominence in the wake of the spread of metalworking. With the introduction of local metalworking, people would have gained an understanding of the properties of bronze. It would have become evident to them that bronze artefacts had a more complex use life than stone artefacts, or even pottery. Copper ores had to be crushed and smelted in order to produce metal. At the end of their use-lives bronze objects could be remelted and worked into new artefacts. These technologies were all embedded in a wider cosmology and ideas about life as a series of transformative cycles. Cremation would have made sense within such a cosmology, as it involved the transformation of human beings through fire (Brück, 2001; Melheim, 2004).

These theories seem to imply that the understanding of the nature of bronze and its transformations would have been available to all. However, even today, technology carries with it implications of power (Dobres, 2000, 14-15), and this is unlikely to have been different in the past. The very nature of the technological process, with its repetitive nature, special skills, elements of display and prestige made it a prime example for ritualisation. Therefore, Nikolaidou (2007) argued, the production of prestige objects would have involved complex cultural and ritual knowledge, probably jealously guarded. That bronzeworking would have had ritual and mythological connotations and involved symbolic knowledge that would not have been available to everyone in the society, just as metalworking has in present-day traditional societies, is relatively widely accepted (Barber, 2003). However, these aspects of power and exclusive knowledge are rarely discussed when metalworking is linked to cremation. A notable exception is the work of Goldhahn (2007) and Østigård (2007) in their two volumes on the role of metalworkers/smiths as ritual experts in Scandinavian prehistory from the Bronze Age through to the Viking Age. In the Bronze Age volume, Goldhahn (2007) explored the role of the first metalworkers and their privileged position due to their knowledge of how to work bronze. It was the transformative nature of metalworking which gave smiths the role of ritual specialists and cremators. In the volume on later prehistory (including the Viking Age), Østigård (2007) charted the changes that occurred with the introduction of iron, and how the status of smiths declined during the Viking Age, a change which was also related to changes in cremation rituals.

Bronze is not the only prestigious material produced using fire in the Bronze Age. Faience, a vitreous paste similar to glass, was also an important innovation to the people of Bronze Age Britain. When found in graves on the British Isles, this material is almost always associated with cremated women (Sheridan and Shortland, 2004, 266-267). Whether faience, which had begun its life through the use of fire, was deemed as particularly suitable to be transformed with a body on a funeral pyre, remains to be further explored.

These new theories are important in that they explore the meanings behind cremation, and how cremation relates to other spheres of society. However, it is clear that there is still a divide between osteoarchaeologists and more theoretical archaeologists. The osteoarchaeological method in itself has not been adapted to detect as much as possible about the mortuary ritual. Examples such as the *anthropologie de terrain* show that osteoarchaeology can give detailed information about the treatment of the dead body, which can be used to reconstruct more of the mortuary ritual.

2.4 The process of cremation

From a purely chemical/technological point of view, cremation can be said to be the reduction of a body to its inorganic components, minus water, through the use of fire. Fire is central to the understanding of cremation as a chemical process. In order to start and sustain a fire, three components are needed: fuel, oxygen and heat (Fairgrieve, 2008, 23). Once the fire starts, it can generate enough heat to be self-sustaining, as well as light (DeHaan, 2008, 1). Fire is an oxidation reaction, meaning that it concerns the transfer of electrons between an oxidiser and a reactant. The oxidising agent takes on electrons, and is reduced. The reactant has electrons taken away and is oxidised. For cremation, oxygen is the oxidiser, and the fuel, including the dead body and the pyre material, is the reactant(Holck, 2008, 22-23).

Although the body itself contains combustible materials which will act to fuel the fire (see below), other fuel is necessary to start the fire and raise the temperature of the body to the point where it will ignite and burn. In modern crematoria, gas is usually the most common fuel (McKinley, 1994c, 74). In traditional pyre cremation, wood would have been used, although there is also evidence of other fuels, such as peat and seaweed (Photos-Jones et al., 2007). What these fuels have in common is that they are rich in carbohydrates, which burn readily. In ethnographic sources, fats, such as clarified butter, are sometimes mentioned as accelerants (Oestigaard, 2007, 27).

As shown in Figure 2.1, the functional constituents of the human body can be divided into blood, bone, adipose tissue, skeletal muscle and other (a group that includes parts such as the skin and the connective tissue). On a molecular level, these constituents are built up by four components: water, fat, protein and mineral. Of these components, protein and fat are combustible whereas water and mineral is not. The combustible groups will release energy in the form of heat when the body is being burnt. The non-combustible will require energy; water in order to evaporate and the mineral component in order to break down (Holck, 2008, 27).

The most relevant component in the burning of a human body is fat, which is stored in fat cells within the adipose tissue. The fat in the human body consists mainly of triacylglycerols (TAG), which in turn consist of three fatty acids and

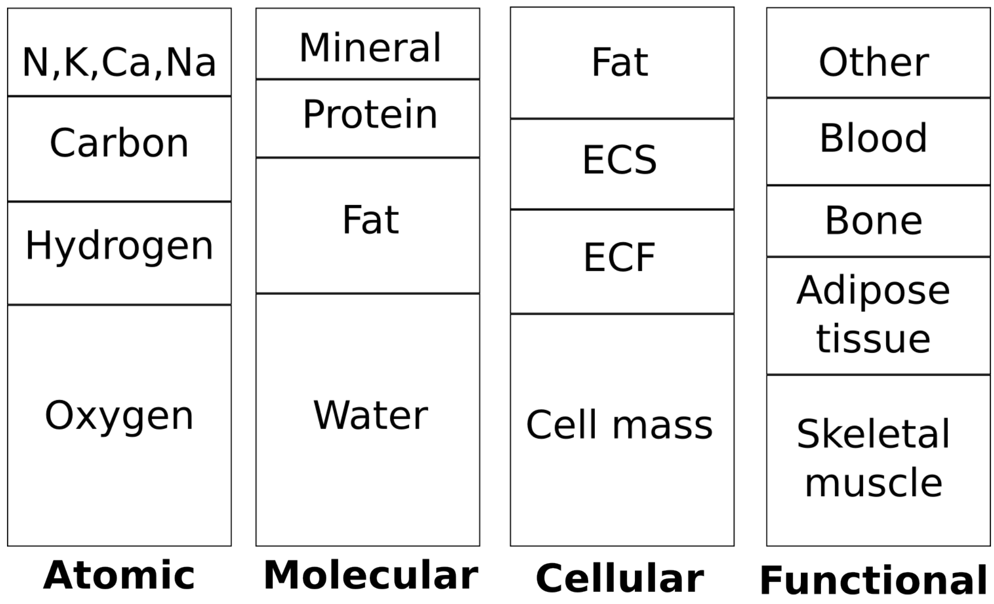

Figure 2.1: Multicompartment model of human body composition, adapted from Ellis (2000, 652).

glycerol. Triacylglycerols are the body's main way of storing energy, containing 9 kcal/g compared to 4 kcal/g in carbohydrates and proteins (Campbell and Farell, 2010, 194-195). The concentrated energy means that the subcutaneous fat in the human body fuels the fire if a high enough temperature is sustained for long enough to affect it. In a modern crematorium, the amount of fat in an average human body provides enough fuel to keep the body burning even as the jets of gas are turned off (McKinley, 1994c, 74).

Protein, the other combustible component in the human body, does not contain as much energy as fat (Fairgrieve, 2008, 29-30). Tissues rich in protein, such as muscle and connective tissue, burn less well than fat. This means that releasing the energy in them is more difficult. It takes more energy to burn leaner individuals than those with more body fat (Holck, 2008, 27). The high water content of the human body serves as an obstacle to burning, as water requires energy to evaporate. For this reason, body parts with high water content, such as the abdomen, tend to take longer to burn (McKinley, 1994c, 75). Much of the mineral component in the body is found in the skeleton and dentition. After a complete cremation, most of the remains consist of mineral matter.

The way in which the body is affected by burning depends on whether the source of heat is radiant heat or direct fire. In the former, the body will be reduced through the evaporation of fluids. In the latter, which is more applicable to the case of pyre cremation, the body itself will act as a fuel for the fire, leading to more advanced destruction (Fairgrieve, 2008, 42). When the body is exposed to heat, the first tissues to undergo change are the most superficial ones, the epidermis, as well as the hair and the nails (Fairgrieve, 2008, 42-43). Once the epidermis has ruptured and contracted sufficiently to expose the underlying subcutaneous fat, this fat can start to fuel the fire (DeHaan et al., 1999). Subcutaneous fat will not smoulder, but burn as turbulent flames as long as there is something to act as a wick, such as charred wood, clothing or bone. These flames can produce average temperatures of 800°C. At this point, muscle and connective tissue will also be affected by fire, which will start to degrade or ignite (DeHaan, 2008, 9).

If the body is fresh at the time of burning, and has not yet attained rigor mortis, the muscles will contract, leading to the so-called 'pugilistic'pose. In this pose, the major contraction of the flexor muscles of the body leads to a position in which the head is extended, the arms bent at the elbows, the fingers clenched, the thighs will be flexed, and so on (Fairgrieve, 2008, 44-45). The presence of the pugilistic pose in bodies which have passed the state of rigor mortis is a matter of some debate (Roberts, 2011, 127). It has been observed in bodies cremated at crematoria, in bodies which are unlikely to be completely fresh (Bohnert et al., 1998, 13). Some argue that it is mainly associated with bodies of individuals having perished in the flames, as muscles in bodies in which autolysis had already set in will arguably not shrink and contract in the same way (Holck, 2008, 112). As the muscles are further destroyed by the fire, they will shrink, causing characteristic, u-shaped fractures on the underlying bone (Symes et al., 2008, 44-45).

Once any shielding soft tissues are sufficiently destroyed, the bone will be affected. At first, the periosteum, the membrane covering the bone, will be charred and flake off (Fairgrieve, 2008, 47), before the bone is more deeply affected by the fire. The first areas of the skeleton to burn are those with little covering, such as large parts of the face, elbows, knees, ankles and phalanges of hands and feet (Symes et al., 2008, 30). Areas with a thicker covering of soft tissue will burn later in the process (Bohnert et al., 1998, 18). The differential rate in which parts of the skeleton are exposed when a body is burned while still fleshed means that burning is never uniformly affecting the entire surface on any one bone at any one time (Symes et al., 2008, 36). For this reason, bone burned while still fleshed shows a greater range of colour variation than dry and defleshed bone (Buikstra and Swegle, 1989, 256).

Apart from purely anatomical factors, burning is also affected by contact points, that is to say points where the body is touching another material. This will serve to insulate the affected area, as the oxygen supply is cut off. In a body lying on its back, the areas affected will be the back of the head, the back and the buttocks (McKinley, 1994c, 74). In observations of crematorium cremations, the back of the head was intact even after an hour or more of burning (Bohnert et al., 1998, 18). Wells (1960, 35) suggested that in bodies which had been placed prone into the cremation oven, bones such as vertebrae, occipital and scapulae were more completely calcined than in bodies cremated in a supine position, as they were closer to the burners.

Bone is a composite material, consisting of an organic matrix and a mineral component. The organic component, which gives bone its tensile strength, is to a large degree made up of the protein collagen (Vuorio and De Crombrugghe, 1990). The mineral component is hydroxyapatite, a type of calcium phosphate. Crystals of this mineral are formed by cells within the bone and gives bone its rigidity (Elliot, 1994). As bone is heated, changes occur to the microstructure. The effects of these changes are visible to the naked eye as the bones shrink, warp and change colour (Fairgrieve, 2008, 137-38). As the cremation process proceeds, the heat will cause the oxidation of the organic portion of the bone, the loss of water and the recrystallisation and the eventual fusion of apatite crystals within the bone (Holden et al., 1995a).

Correia (1997) has divided the heat-related changes to bone into four stages. The first stage is dehydration, at between c. 105-600°C. During this stage the water inside the bone evaporates. As the hydroxyl bonds between the oxygen and hydrogen molecules within the hydoroxyapatite break, the water bonded in the mineral portion of the bone is lost. The second stage, decomposition, occurs at c. 500-800°C. During this stage, the organic material in the bone decompose, a process known as pyrolysis, producing carbon dioxide. The carbonates produced during this stage are lost during the next stage, inversion, which occurs at c. 700-1100℃. During this stage, there is a change in the crystal structure of the bone. The hydroxyapatite in the bone alters, and becomes beta-tricalcium phosphate, another form of calcium phosphate. The last stage, fusion, occurs at over 1600℃. During this stage, the crystals of the bone melt (Correia, 1997, 280-81). The last stage is not relevant for pyre cremation, which never reaches these extreme temperatures.

2.5 Sources for reconstructing ancient cremation

2.5.1 The need for reconstruction

Although cremated remains are commonly encountered in the archaeological record, the understanding of pyre cremation is relatively poor, both among archaeologists in general and among osteoarchaeologists (Henriksen, 1991; Williams, 2004). This result in faulty interpretations, which are then perpetuated. One example is the long-standing notion among Scandinavian archaeologists that clean (in contrast to 'sooty') cremated remains from Bronze Age burials were carefully washed after being removed from the pyre and before being put into urns (e.g. Kaliff, 2007). However, experimental cremation shows that bone fragments are not sooty after cremation, and that their fragile nature would cause extensive fragmentation if washed (Arcini, 2007). Another example is how Anglo-Saxon cremation was thought to involve placing the corpse on the ground, and then piling the pyre on top (Wells, 1960). The theory was based on the observed differences in calcination patterns between remains of crematoria cremations and Anglo-Saxon cremation burials. In contrast, experimental cremation suggests that a corpse placed under a pyre would not burn well at all, since it would quickly be buried in ash (McKinley, 1994c, 83). Although the basic method behind this theory, making deductions using observable modern cremation, was sound enough, the understanding of thermodynamics and the nature of a funeral pyre were lacking.

It is clear from these examples that the building and firing of experimental funeral pyres, as well as a basic understanding of how fire affects bone, are vital for reconstructing past mortuary rituals. Unlike pyrotechnologies such as metalmaking (Gansum, 2004), ancient cremation cannot be directly replicated, as open-air pyre cremation of human corpses is illegal in most parts of the world. For this reason, the understanding of pyre cremation comes mainly from four sources: ethnographic or ethnohistoric accounts of modern or ancient pyre cremation; experimental pyres using non-human animals as proxies for humans; the burning of human and animal parts in a laboratory environment; and finally the observation of modern day crematorium cremations.

2.5.2 Ethnography and ethnohistory

Accounts of real pyre cremations are the most similar to how pyre cremations would have been carried out in the past. The accounts include ethnohistorical or historical accounts of past cremations. Ethnographical and ethnoarchaeological accounts involves ethnographers or archaeologists observing modern day pyre cremations. Accounts of past cremations can be found in famous literary works such as The Iliad (Homer, 1995), in which Homer describes the funeral pyre of Patroclus; or Beowulf (Swanton, 1997), which contains descriptions of two instances of cremation. Both of these accounts describe what would already have been the past when they were written down. The Iliad describes events of the Bronze Age, four hundred years before Homer's time (Holck, 2008, 7). The funeral pyre of Patroclus is described as being very large, and contained not only the dead man, but sacrificial animals, including sheep, cattle, horses and dogs, as well as twelve Trojan youths. After the pyre had died down, the ashes of Patroclus were collected, and put into an urn. The pyre site was covered with a mound (Book XXIII:108-191, Book XXIII:192-261).

Beowulf is an Anglo-Saxon epic poem which is set in Denmark and Sweden during a mythical past, perhaps most closely relating to the 6th or 7th century (Owen-Crocker, 2000, 116-118). The two cremation burials in Beowulf, that of the dead warriors from a skirmish between Danes and Frisians and later that of Beowulf himself, are quite detailed. The cremation of the dead warriors mentions them being cremated in their mail, with their weapons. The destructive effect of the fire on the corpses is vividly described (lines 1106-1124). The cremation of Beowulf contains details of the laments of the mourners, as well as of the building of the pyre and the grave mound, which is said to have taken ten days (lines 3137-3177). The descriptions of specific grave goods and the process of cremation itself does seem to indicate that the account is based on actual cremation practices (Owen-Crocker, 2000, 54-55). Probably the most famous account of an early European pyre cremation is that of Ibn Fadlan, an Arab traveler who witnessed the rituals surrounding the cremation and burial of a chieftain of the Rus, Scandinavian traders living by the Volga in what is now Russia, in the early 10th century. Ibn Fadlan's account is very detailed, describing a long process of rituals and feasting, culminating in the violent rape and killing of a slave girl, who was cremated with the dead man on a ship. The ship/pyre site was then covered by a mound (Parker Pearson, 1999a, chapter 1).

More recent accounts of pyre cremation include the observations of G.A. Robinson, who studied the customs of Tasmanian Aborigines in the 1820s and 30s (Hiatt, 1969, 104-105). He described how a corpse was first tied into a crouched position, before being cremated on a low pyre. As the body burned, the mourners left the spot, only to return on the following day. Pyre cremations are still performed in certain parts of the world, such as India and Nepal. For these areas, there are more recent ethnographic studies available. The work of Parry (1994) is an ethnography of the rituals of death and mourning in the holy city of Banaras (also known as Benares or Varanasi) in India. The account is based on observations of pyre cremation and interviews with professional cremators during the 1970s and 1980s. In contrast, the ethno-archaeological fieldwork of Oestigaard (2007) was carried out in rural parts of Nepal in the 1990s. The pyre cremations observed were carried out by the mourners on burial grounds situated by certain rivers. Unlike Parry (1994), Oestigaard (2007) was able to observe the cremation at a closer distance, as well as observe the remains of the pyre sites afterwards. Each cremation was carried out on a clean piece of land, in other words one where there had not been a pyre before. After cremation, the ashes were thrown into the river, and the remains of the pyre site itself were left to be washed away by the river as it rose in spring. Although cremation was seen as the preferred mortuary ritual, many people were buried due to the high cost of pyrewood, equivalent to a month's wages.

First-hand accounts of pyre cremations are important for reconstructing past cremation. They offer insights into aspects which cannot be accessed through the archaeological record, including displays such as laments, specific taboos imposed on the mourners and the parts of the rituals which included spoken words. In some cases they can describe what the cremation itself looked like, and how it was perceived by those watching it. They can also widen our understanding of such aspects such as the preparation of the body before cremation, the building of the pyre, the selection of pyre goods, the collection of the bones afterwards and the final deposition of the remains. Nevertheless, there are limitations. For the oldest accounts, different translations may vary slightly, and some details are lost in translation. In the case of the account of Ibn Fadlan, the earliest translation into English was heavily censored (Anderson, 1872). Later commentators have drawn attention to how Ibn Fadlan himself was not necessarily a neutral observer, and how his informants themselves may have been unwilling to explain various parts of the ritual, leading to more misconceptions (Taylor, 2008). Quite apart from such problems, a serious limitation for the osteoarchaeologist is the lack of detailed insight into the cremation process itself, or descriptions of the resulting cremated remains.

2.5.3 Experimental pyres

Modern archaeologists have used other mammals, including pigs, sheep, apes and rabbits as proxies for humans (e.g. Piontek, 1976; Gräslund, 1978; Buikstra and Swegle, 1989; Henriksen, 1991; Sigvallius, 1994; McKinley, 1997; Jonuks and Konsa, 2007). Such experimentation has served to give archaeologists insight into past cremation (Henriksen, 1991). By building and firing replica pyres, archaeologists can learn about past cremation in a more hands-on way, rather than simply experiencing it second-hand from written sources. These studies often emphasise the technological know-how involved, including aspects such as fuel requirements and pyre construction (e.g. Henriksen, 1991). Quite often, experimental cremation is used to further the understanding of archaeological matters such as the destruction of pyre goods and the identification of pyre sites in the archaeological record (Gräslund, 1978; Jonuks and Konsa, 2007), or of temporal aspects, such as for how long a pyre would burn, or how long it would take to collect the remains from the pyre site (McKinley, 1997). A limitation of experimental pyres is that animal bodies differ from human ones in their ratios of soft tissues as well as in body shape. This affects the burning, but is rarely discussed (Jonuks and Konsa, 2007).

2.5.4 Burning of human and animal parts

As most of the studies of the type mentioned above are not designed to further understanding of the changes in the bones, osteologists have often had to rely on other sources to understand the cremation process. For this reason, the burning of human and animal parts in laboratory environments, using bunsen burners, ovens or similar, are very important. Most such studies have focused on changes in the morphology and colour to bone and teeth (e.g. Shipman et al., 1984; Nicholson, 1993; Holden et al., 1995b; Hiller et al., 2003; Devlin and Herrmann, 2008; Walker et al., 2008). Another strand of research explored the possibilities for differentiating bone burnt as dry bones, recently defleshed bones or whilst still fleshed (e.g. Webb and Snow, 1945; Baby, 1954; Binford, 1963; Thurman and Willmore, 1981; Buikstra and Swegle, 1989). As with pyre experimentation, the animals most commonly used are pigs, although other species have been used. The understanding of the early stages of burning has been enhanced by the burning of soft tissue, including fat (e.g. DeHaan et al., 1999). While the nature of laboratory burning means that factors such as temperature and duration of burning can be monitored and controlled, there are also limitations. The burning of parts of bodies, or even defleshed bones, are far removed from the cremation of complete bodies on outdoor pyres.

2.5.5 Observation of modern crematoria cremations

Modern crematoria cremations have the potential to provide osteologists with detailed information about the process by which a human body is consumed by fire. Although until recently, it was not unknown for osteologists to visit crematoria to observe cremations, and even study the remains (e.g. Gejvall, 1947; Wells, 1960; McKinley, 1993), research providing detailed accounts of the process of cremation is rare (Günther and Schmidt, 1953; Richards, 1977; Bohnert et al., 1997, 1998). Of the two more recent studies, one focuses solely on the skull (Bohnert et al., 1997). Such studies provide insight into the order in which different parts of the skeleton become exposed to fire, and how they are affected by the fire. Knowing this sequence is important, as comparisons with this known 'normal' process of destruction can help osteologists detect variations in past mortuary rituals (Symes et al., 2008). The obvious strength of such research is that it is the only type of cremation-related research which focuses on complete human bodies, thus removing the biases seen in animal research, or the burning of human body parts.

However, there are also drawbacks. In contrast to pyre cremations, crematoria cremations are performed in a controlled environment, unaffected by weather and variations in terms of quantity and quality of fuel. Furthermore, the position of the body in relation to the source of heat is different. In a crematorium the burners are placed above the body and directed downwards. On a pyre, the body would have been placed on the top. Apart from this, observations of crematorium cremations describe the process of cremation, whereas cremation burials are the end result of cremation. As far the author has been able to ascertain, there are no studies which combine observations of the cremation process with a detailed study of the resulting remains. Additionally, there are problems with the observation, as the burning can only be observed from one angle, and often only from a small window. One of the studies mentions that this made it difficult to observe what was happening with the legs and feet of the body (Bohnert et al., 1998).

Chapter 3

The Bronze Age context

3.1 Defining the Bronze Age

The Bronze Age is the second age of Thomsen's three ages. In its widest sense, the Bronze Age is still defined as the period of time between the introduction of the earliest metalwork to the widespread use of iron as the main raw material for tools (Cowie and Shepherd, 1997, 151). In temperate Europe, the Bronze Age lasted between c. 2500 BC and 800 BC, although this varies slightly for different regions (Harding, 2000, 1). Bronze, an alloy of copper and tin, is a technological innovation which ultimately hails from south-east Europe, where native copper (copper found naturally in its metallic state) had been used for trinkets and personal ornamentation since the eighth millennium BC. Methods to smelt and work copper developed later, in the fifth millennium BC (Kienlin, 2012, 129-131). During the third millennium BC, the experimenting with alloys lead to the discovery of bronze (Parker Pearson, 1999b, 78). The fact that sources of copper and tin are very rarely found together meant that the production of bronze was dependent on trade and contact between people. The importance of this trade has long been emphasised in studies of the Bronze Age, and the period tends to be defined in terms of change and expansion (e.g. Childe, 1930; Kristiansen, 1998).

Early chronologies divided the Bronze Age into periods, and formed the foundation for comprehensive studies. The chronologies were developed by different scholars during the last decades of the nineteenth century and the beginning of the twentieth century (Gerloff, 2007, 118). The most influential of these chronologies were those of Oscar Montelius and Paul Reinecke (Kristiansen, 1998, 32). Oscar Montelius established a relative chronology of Scandinavian bronze objects from closed contexts (Montelius, 1885). This chronology was then correlated to the absolute dates from areas where such dates existed, such as Egypt and the Near East. The work of Montelius inspired Paul Reinecke to develop a similar system for central Europe (Reinecke, 1902). Reinecke divided his system into six periods, following Montelius, but acknowledged that his periods did not correspond exactly with that developed by Montelius (Gerloff, 2007, 118-119). Even though the chronologies of Montelius and Reinecke have been affected by later radiocarbon dating, it is worth noting that radiocarbon dating has largely confirmed their absolute dates (Kristiansen, 1998, 35).

In Britain, the beginning of the Bronze Age was traditionally the point when the first Beaker pottery appears in graves (Barclay, 2003, 149). Earlier than the work of Reinecke and Montelius, the English antiquarian John Evans had divided the British Bronze Age into Early, Middle and Late, based on Egyptian terminology (Evans, 1881). However, during the last few decades, it has become increasingly popular to divide the Bronze Age into Earlier and Later. In this case the Early and Middle Bronze Age become the Earlier Bronze Age and the Late Bronze Age becomes the Later Bronze Age (Burgess, 2004, 344). Pottery typologies have held a dominating position in British Early Bronze Age dating schemes since the early 20th century (Parker Pearson, 1999b). During the Later Bronze Age pottery styles become less diagnostic (Gibson and Woods, 1997, 72) and thus less useful for dating purposes, whereas metalwork remained important (Champion, 1999).

The introduction of radiocarbon dating proved very significant for dating the Bronze Age (Champion, 1999, 97). In the late 1960s it revolutionised the study of the Neolithic and the Bronze Age, and it was even suggested that radiocarbon dates could replace cross-dating with the Mediterranean (Renfrew, 1969). The limitations of radiocarbon dating are now better understood, and modern dating schemes involves radiocarbon dating of a wide variety of artefacts and human remains (Sheridan, 2008b). Even though radiocarbon dating is very important, it will never completely replace older methods based on typology (Gerloff, 2007, 154). Instead, the correlation between absolute chronologies, dendrochronological dating and radiocarbon dating is highly important (Kristiansen, 1998, 35). Gerloff (2007) has correlated different chronologies for the Bronze Age in Europe, and in her revised chronology the British Early Bronze Age dates from c. 2300 cal BC to c. 1600 cal BC, the Middle Bronze Age dates from c. 1600 cal BC to c. 1150 cal BC and the Late Bronze Age from c. 1150 cal BC to c. 650 cal BC.

During the second half of the 20th century and early 21st century, there was a tendency to avoid the three age system and the term Bronze Age in studies of the British Bronze Age (Burgess, 2004, 341). The underlying reason behind this was that the term Bronze Age was seen as a relic of the antiquarian age, when it was believed that invading Beaker People arriving from the continent ended the Neolithic and ushered in a new age (Barber, 2003, 28). This picture did not sit well with the archaeological record, which seemed to indicate continuity in society from the Late Neolithic period to the Bronze Age (Barclay, 2003, 149), and a change in society from the Earlier Bronze Age to the Late Bronze Age (Champion, 1999). The result, as suggested by a relatively recent review of current British research agendas, is that the Bronze Age is hardly ever treated as a period in its own right, instead, the Earlier Bronze Age tends to be lumped together with the Late Neolithic and the Later Bronze Age with the Iron Age (Last, 2008, 36). Thus, fewer publications deal specifically with the Bronze Age (Brück, 2008, 341), and there are few Bronze Age specialists (Burgess, 2004, 352).

The lack of specific Bronze Age research during the last decades means that broader understandings of the cultural context of the Bronze Age may be lost to archaeologists (Brück, 2008). Furthermore, much of the published material on the British Bronze Age deals with purely theoretical aspects spanning larger swathes of prehistory, while studies of the artefacts are neglected. The basic information on material culture is difficult to obtain due to it being published in a variety of different outlets with few overviews. The lack of synthesis means that it is difficult for outsiders to understand and criticise Bronze Age research and hard for students to gain an overview of the period (Brindley, 2008).

More recently, there has been a change, and there is now a tendency to adopt the continental Chalcolithic label to the period from the introduction of the Beaker package to the widespread use of bronze (e.g. Sheridan, 2008b; Needham, 2012). The adoption of continental terminology emphasises the similarities between Britain and continental Europe. This is a contrast to earlier trends, as mentioned above, which eschewed the three age system and emphasised the uniqueness of the British archaeological record. The trend for including Stonehenge in the name of many of the significant publications dealing with the British Bronze Age (e.g. Burgess, 1980; Gibson and Sheridan, 2004; Burgess et al., 2007), has, however, continued until fairly recently. The term Chalcolithic or Eneolithic denotes a period when copper was used, but was not mixed with tin to form bronze (Bartelheim and Krauss, 2012). More recently, some scholars have argued that the use of copper in Britain from 2500 BC to the introduction of bronze around 2200 BC, as well as the changes caused by the introduction of the Beaker package leaves a window that can properly be called a Chalcolithic or Copper Age (Sheridan, 2008b; Needham, 2012). Others are less convinced, arguing that the label is confusing and less useful than the traditional Neolithic and Bronze Age labels. Bartelheim and Krauss (2012) suggest that what is labeled Chalcolithic in various parts of Europe varies significantly, and hardly overlaps. Furthermore, they argue that it is unhelpful to focus so much on copper, as it was not the dominant feature of the economy in most parts of Europe during what is labeled the Chalcolithic, including Britain.

Cremation is the mortuary ritual most closely associated with the Bronze Age, as it became prominent during the second half of this period (Harding, 2000, 111-112). Overviews of the Bronze Age, whether dealing with the archaeological record of Europe as a whole, or of Britain, rarely discuss this ‘rise of cremation’. It is notable that some scholars do not mention it at all (Kristiansen, 1998; Ruiz-Gálvez Priego, 1998; Kristiansen and Larsson, 2005). Others mention the spread of cremation, but do not discuss any possible reasons behind it, or do so in very general terms (e.g. Childe, 1930; Coles and Harding, 1979; Burgess, 1980; Parker Pearson, 1993; Harding, 2000). It is sometimes suggested that a change from inhumation to cremation might indicate a change in religious beliefs or ritual, and that it might even indicate an influx of people (e.g.

Coles and Harding, 1979; Harding, 2000). A detailed, if controversial, view on the reasons behind cremation is found in the work of Kaliff (2007), in which it is argued that cremation was part of a package of Indo-European ritual and culture which spread during the Bronze Age. However, another influential work on the presumed spread of Indo-European culture does not mention cremation as part of the Indo-European package (Anthony, 2010).

3.2 A history of Bronze Age research in Scotland

In an early discussion of prehistoric cremation, Jamieson (1822) challenged the prevailing notion that all cremation burials found in Britain belonged to the Romans, as believed at the time. Based on comparison with historical sources describing Roman cremation and burial, as well as historical sources of cremation amongst other groups, he argued that the cremation burials found in cairns, mounds, flat cemeteries and other sites, had to belong to the native people, and that they probably preceded the Roman presence in Britain. Nevertheless, Jamieson did not realise the age of these burials, nor did he ascribe them to a particular period. It would take some 30 years before Wilson (1851) published his *The Archaeology and Prehistoric Annals of Scotland*, which was the first publication to apply the newly devised three age system to British prehistoric archaeology (Simpson, 1963). Although the late 19th century and early 20th century saw important developments in the study of the British Bronze Age as a whole, notably Evans (1881) for bronzes and Abercromby (1912a) for pottery, these did not treat the Scottish Bronze Age as separate from the English or include separate chronologies for it. It was not until the 1920s that Callander (1923) presented a separate chronology for Scotland, based on Bronze Age hoards. In the following decades, V. Gordon Childe published two works on Scottish prehistory (Childe, 1935, 1944). Having compared artefacts, particularly bronzes, found in Scotland to the English material, he suggested that the Scottish Bronze Age lagged slightly behind the English.

The second half of the 20th century saw important research into Bronze Age metalwork in Scotland, with the publication of a series of papers by Coles, based on his doctoral research (Coles, 1960, 1964, 1969). The papers outlined the metal objects and related artefacts (moulds) found in Scotland and belonging to the Early, Middle and Late Bronze Age. In his 1969 paper, outlining the metalwork of the Early Bronze Age, he suggested a chronology of industrial phases of the Scottish Bronze Age (Coles, 1969, 76). Nevertheless, he acknowledged that the few existing radiocarbon dates would push his dates back slightly (Coles, 1969, 110). There was also an advance in the study of funerary pottery, with three volumes published on various types of Early Bronze Age types. The publications on Beakers (Clarke, 1970a,b) and Collared Urns (Longworth, 1984) covered the material from all of Great Britain and Ireland, while the one on Food Vessel Urns dealt specifically with those of Northern Britain (Cowie, 1978). Recent overviews of the Scottish Bronze Age are rare, with only one significant book published on the topic (Ashmore, 1996). In 2004, the publication of *Scotland in Ancient Europe: The Neolithic and Early Bronze Age of Scotland in Their European Context* (Shepherd and Barclay, 2004), provided papers on a variety of aspects of the Early Bronze Age, such as metalwork (Cowie, 2004; Needham, 2004), faience (Sheridan and Shortland, 2004) and burial practices (Brück, 2004).

An important development since 2000 is the development of a method for radiocarbon dating cremated bones (Lanting et al., 2001). This enabled dating programmes targeting artefacts associated with the bones, including various types of funerary pottery and pyre goods. The National Museums Scotland (NMS) conducted various dating programmes targeting the Scottish Bronze Age, significantly increasing the number of radiocarbon dates for this period (Sheridan, 2008b, 61), and the *Dating Cremated Bones Project* has been an important part of this initiative (Sheridan, 2002, 2003b, 2004b, 2005, 2006, 2007c, 2008a). The various radiocarbon dating programmes have resulted in new chronologies of Beakers (Sheridan, 2007b), cinerary urns (Sheridan, 2003a) and Food Vessels (Sheridan, 2004a). However, despite such initiatives, there is an uneven geographical distribution of datable material (Ashmore, 2004, 127-129). Some areas, such as Northeast Scotland, are very well represented, whereas other areas are lagging behind (Sheridan, 2008b). An ongoing challenge is to fit new dates into archaeological narratives, in order to better understand specific aspects of society, and how these changed over time.

3.3 Scottish Bronze Age society

The Bronze Age is associated with a decline in climate (Tipping and Tisdall, 2004) and environmental change including woodland loss, podzolisation, soil erosion and the spread of blanket peat (Davidson and Carter, 2003). Whether human activity or environmental factors were the chief reason behind these changes is a matter of debate, although it seems the latter is currently the most favoured. Recent research suggests that the spread of blanket peat began before the Bronze Age (Tipping, 2008), and in some cases could have been kept in check by farmers (Tipping, 1995). Soil erosion increased after 5000 BP, with the introduction of farming (Davidson and Carter, 2003, 58-60). However, at least in some places, it appears to have been caused by climatic deterioration, rather than human activity (Reid and Thomas, 2006). Palynological evidence suggests increased deforestation from the Neolithic onwards (Edwards and Whittington, 2003, 73). At least some of it was due to climatic reasons, such as the decline in pines in northern Scotland (Huntley et al., 1997, 172). Cutmarks in pines found in blanket peat did not prove that the decline was due to human activity, as the cutting occurred long after the trees themselves had died, when the trunks were already buried in peat (Tipping et al., 2008).

Farming and cultivation was already practiced by the beginning of the Bronze Age, but the Middle Bronze Age saw an expansion of settlement and agriculture, including an increase in upland settlements (Davidson and Carter, 2003, 59). The expansion, and particularly the spread into previously uninhabited upland areas is traditionally thought to have been caused by a significant population increase (e.g. Piggott, 1972). However, the population increase is difficult to prove, as is the assumption that there was a large-scale abandonment of upland areas due to climatic decline later in the Bronze Age, which can be questioned based on palynological evidence (Tipping, 2002). The most well-known form of settlement belonging to the Scottish Bronze Age is the unenclosed roundhouse. These structures were relatively simple, and probably did not last a decade. It seems as if sites were occupied for short periods, then abandoned, even though the surrounding land was kept in use (Halliday, 2007). Bronze Age economy depended on crop production and livestock. The fields are not as clearly recognisable as in southern Britain, but remains of cultivation are increasingly being identified, such as the cultivation ridges found under the North Mains barrow, Strathallan, Perthshire (Barclay, 1989). Metal, in the form of gold and copper, occured in Scotland from c. 2400-2500 BC (Coles, 1969; O'Connor, 2004). Tin-bronze replaced copper from c. 2100-2200 BC (Needham, 2004). Another metal used was lead, which has been identified in a lead and cannel coal bead necklace found in the Early Bronze Age cist cemetery excavated in West Water Reservoir, Peeblesshire (Hunter and Davis, 2000).

As to the nature of the societies of Bronze Age Scotland, the available evidence could be interpreted to suggest that they were socially differentiated. The building and use of labour-intensive monuments, including ceremonial sites (Bradley, 2005a) and burial monuments (Bradley, 2000), implies a level of social stratification. This notion is enforced by the presence of high-status burials, furnished with rich grave goods. As will be discussed in more detail in the section on mortuary ritual (see below), high-status grave goods include metal objects (Coles, 1969), faience (Sheridan and Shortland, 2004) as well as imported materials such as jet (Sheridan and Davis, 2002). The presence of rich children's graves (McLaren, 2004) could indicate that this wealth, and possible related status, was inherited. What the wealth means is more difficult to interpret; did it belong to the dead individual or to his or her family and kin? The Bronze Age has been interpreted as heralding the rise of the individual, due to the presumed rise of single burial, but such an interpretation is perhaps no longer valid, with the increasing evidence of similarities between Late Neolithic and Bronze Age burial practices (Brück, 2004).

Among earlier generations of scholars, some, such as Abercromby (1912b) and Childe (1944) were not afraid of making interpretations on the nature of Bronze Age society, whereas others, such as Wilson (1851) and Coles (1960) were more interested in the typologies and chronologies of artefacts. More recently, however, the trend has been for the focus on specifics, such as types of artefacts or sites, rather than wider interpretations on the nature of Bronze Age societies (Brindley, 2008). A topic which is still very much central to Bronze Age studies is that of incoming immigrants from the continent, one which has been discussed for as long as there has been Bronze Age research in Scotland. Beaker burials, marking the beginning of the Bronze Age, are central to the debate of immigrants from the continent (Sheridan, 2008b). The debate have focused on the number of immigrants needed to spread new ideas and whether their relationship to the existing population was peaceful or not. To antiquarians and early archaeologists, the incoming Beaker People were often portrayed as a large number of immigrants, resulting in significant changes to society. Abercromby (1912b, 73) described the incomers as "ferocious looking invaders [with] no conception of the sanctity of human life". He viewed the spread of Beaker type burials as indicative of a process of colonisation and diffusion by Beaker People, beginning in the south-east of England and spreading towards the north-west Abercromby (1912b, 80-81). Similar ideas were expressed roughly thirty years later, by Childe (1944, 42). Since the 1950s, there has been a switch to a more positive depiction of incomers, emphasising their technological know-how (Piggott, 1958; Clarke, 1970a; Brodie, 1994; Needham, 2005). In a recent overview Sheridan (2008b) highlights how, in the last decade, interpretations of early immigrants have pictured them as high-status adventurers, gaining prestige from their travels (e.g. Case, 2001; Needham, 2005, 2008). The model is not dissimilar to that proposed for the Nordic Bronze Age by Kristiansen and Larsson (2005). Prospecting for copper sources is also likely to have been a motivation, especially for travelers from the Lower Rhine, whose own homelands lacked indigenous sources of metal Shepherd (2012b, 169). Recent research projects include the Beaker People Project, which aimed to investigate aspects including mobility of the Late Neolithic and Early Bronze Age population of Britain (e.g. Jay et al., 2012).

For early scholars, such as Wilson (1851, 160), craniometrics were the preferred tool for separating incomers from natives. More recently, isotopic studies have been used to identify 'isotopic aliens' or individuals who were born on the continent (e.g. Needham, 2007; Jay et al., 2012). However, the spread of exotic raw materials such as jet (Sheridan and Davis, 2002), technologies such as tin-bronze alloying (Needham, 2004) and funerary practices such as Beaker (Sheridan, 2007b) or Food Vessel burials (Sheridan, 2004a) indicate that human mobility was more extensive than what could be discerned from the relatively few individuals who appear to have been buried far from their place of birth. The similarities in the archaeological record over large areas, such as northeast

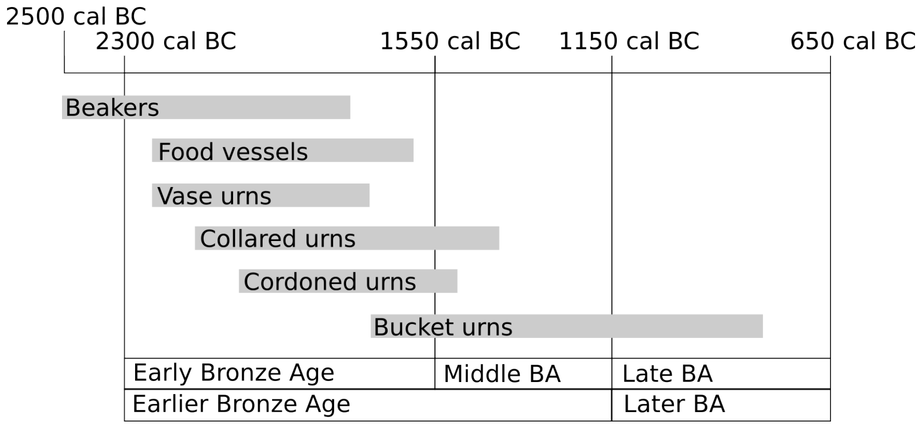

Figure 3.1: Chronology of Bronze Age funerary pottery.

Ireland and south-west Scotland (Waddell, 1992), or across the English Channel (Needham et al., 2006), suggests that movement over water was of great importance, not only in Scotland, but on the British Isles as a whole.

3.4 Mortuary ritual in Bronze Age Scotland

3.4.1 Context

Burial ritual did not change abruptly at the beginning of the Bronze Age, instead the important shift seems to have taken place towards the end of the Earlier Neolithic, around 3000 BC. As the Earlier Neolithic drew to a close, new types of mortuary architecture and new types of burials appeared (Barclay, 2003, 132-133). Clava cairns and recumbent stone circles, both restricted to north-east Scotland, were earlier thought to belong to the Neolithic, but newer work suggests that they belong firmly in the second half of the first millennium BC (Bradley, 2000, 2005a). Other types of mortuary and ceremonial sites traditionally linked to the Early Bronze Age have been shown to have been built and used for a longer period of time than previously thought. Radiocarbon dates from henges span from the first centuries of the third millennium to the mid-second millennium BC, whereas stone and timber settings can be dated from the third millennium through to the early first millennium BC (Sheridan, 2008b, 60-61).

In Scotland, as in Europe at large, cremation increased in popularity during

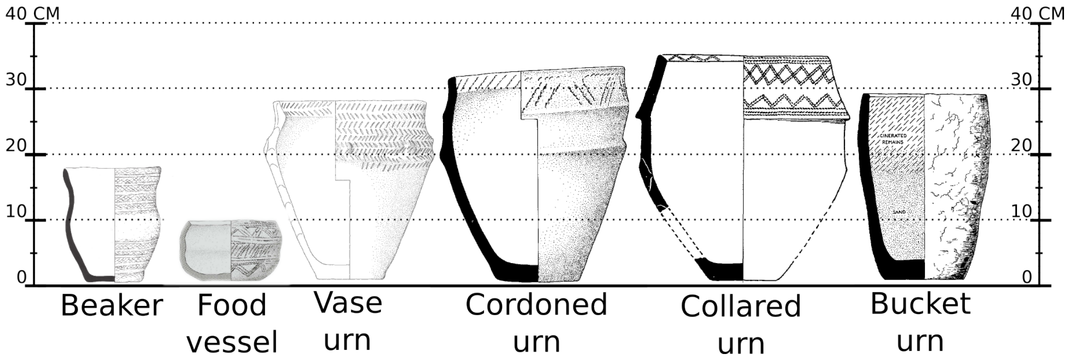

Figure 3.2: Bronze Age funerary pottery. Beaker from Home Farm, Aberdeenshire (Murray and Shepherd, 2007), food vessel from Seafield West, Highland (Cressey and Sheridan, 2003), vase urn from Aberdour Road, Fife (Close-Brooks et al., 1972), collared urn from Kinneil Mill, Stirlingshire (Marriott, 1968), cordoned urn from Moncreiffe, Perth and Kinross (Stewart, 1985) and bucket urn from Glenluce Sands, Dumfries and Galloway (Davidson, 1952).

the Bronze Age (Harding, 2000, 72-75). However, a variety of different practices relating to both cremation and inhumation are represented in the archaeological record, particularly during the Earlier Bronze Age (Brück, 2004). Although the traditional view held that there was a well-defined succession from crouched inhumation burials accompanied by Beakers, then Food Vessels, to the deposition of cremated remains within cinerary urns, it has now been demonstrated that there is a considerable overlap in these practices (Sheridan, 2004a, 260). Table 3.1 shows a chronology of Bronze Age funerary pottery. Table 3.2 depicts the various types of funerary pottery.

3.4.2 The Earlier Bronze Age: inhumation burial

Earlier Bronze Age inhumation burial encompass a variety of different ways of treating the dead, ranging from the burial of single, complete bodies accompanied with elaborate grave goods to the burial of commingled remains of individuals that might have been stored elsewhere before being buried. The types of funerary pottery associated with unburnt individuals of this period are Beakers and Food Vessels.

Beaker Burials are named for the finely made and decorated beakers included in them, which were traditionally thought to have contained a liquid beverage. Beakers are usually six to nine inches high, with thin, decorated walls (Abercromby, 1912a, 17). Apart from the eponymous beakers, these burials tend to contain artefacts such as barbed-and-tanged arrowheads and sometimes other archery equipment. The Beaker package is part of a European-wide phenomenon (Case, 2001). Links to the continent are evident in some Scottish burials, especially earlier ones, which share similarities with Dutch Beaker Burials (Sheridan, 2008b, 63). Several attempts at developing chronological sequences for beakers have made since the end of the 19th century (Sheridan, 2007a, 91). Radiocarbon dates from Scottish beakers suggests that these vessels were in use between the 25th century to c. 1800 BC (Sheridan, 2007b, 99).

Food Vessel Burials are of a more restricted distribution than Beaker Burials, and are only found on the British Isles (Parker Pearson, 1999b, 81). Food vessels were named as such because their coarse fabric, compared to beakers, suggested to early antiquarians that they had contained food, rather than drink. Food vessels tend to be smaller than beakers, but heavier, with thicker walls and less complex ornamentation (Abercromby, 1912a, 93). They appear in two distinctive types: bowls and vases, and generally overlap in style with other vessels of the second millennium BC (Gibson and Woods, 1997, 160-162). Food vessels tend to be associated mainly with inhumation burials in Yorkshire, Scotland and Ireland, but with cremation burials in Wales and northwest England (Parker Pearson, 1999b, 81-82). Radiocarbon dating indicates that food vessels in Scotland were used between c. 2200-1500 BC (Sheridan, 2004a, 249), overlapping with the use of beakers.

Beaker and Food Vessel burials show many similarities. Only a selection of the population were afforded these specific types of burial (Sheridan, 2008b), and cemeteries tend to include individuals buried without funerary pottery alongside those with pottery (e.g. Watkins, 1982; Hunter, 2000). Nevertheless, both sexes and all ages are represented. Studies of Beaker Burials indicate differentiations based on age and sex. The most obvious pattern is that males were placed lying on their left side, oriented east, while females were placed on their right and oriented west. In a study of Beakers in north-east Scotland and Yorkshire, Shepherd (2012a, 99) also found that there was a subtle difference in the ceramics placed in the burials, with shorter, squatter pots more likely to accompany females and a tendency for taller ones in male graves.

Typical high-status grave goods include bronze daggers and battle axes (Sheridan, 2007a, 176,178) as well as jet or cannel coal ornaments, such as necklaces (Callander, 1916; Sheridan and Davis, 2002). Weapons are associated with males, whereas the necklaces are associated with females (Sheridan, 2008b, 68). It would seem that older individuals received richer grave goods than children, although a few rich child burials do occur. A good example is the child burial from Doune, which contained a miniature battle axe as well as two food vessels (McLaren, 2004). Pollen evidence suggests that floral tributes could be placed with the dead, particularly meadowsweet (*Filipendula ulmaria*), which is attested in several cases, such as at Ashgrove, Fife (Tipping, 1994); West Water Reservoir, Borders (Hunter, 2000, 122) and Home Farm, Aberdeenshire (Murray and Shepherd, 2007). The presence of floral tributes serves as a reminder that other organic materials might have formed part of the grave goods.

Scottish Bronze Age societies adapted the ideas of the Beaker traditions to fit into existing traditions, by including beaker type burials into cairns and stone circles (Sheridan, 2008b, 60). Food Vessel burials are also found on these types of sites. Both Beaker and Food Vessel Burials are traditionally thought of as single burials, in which the unburned individual lay crouched (Ritchie and Ritchie, 1991), but there is some variation. The dead are often found buried in wooden coffins (e.g. Cressey and Sheridan, 2003; Watkins, 1982) or short cists (e.g. Smith, 1995; Lawson et al., 2002). Undisturbed cists sometimes still preserve the clay with which they were once sealed (e.g. Galloway, 1920a; Watkins, 1982). Where preservation is good, evidence of how the cist has been furnished may survive, including covers or fern or moss (e.g. Henshall, 1964; Welfare, 1975; Clarke, 1999), or hides placed under the body (e.g. Watkins, 1982). Both Beaker and Food Vessel Burials can also be associated with cremated remains, which will be discussed below.

Crouched burial in short cists continued even after Beakers and Food Vessels fell out of fashion and cremation became the more popular mortuary ritual. Examples include East Campsie, Mains of Balgavies and West Scryne, all from Angus (Taylor et al., 1998). Examples from elsewhere include the double burial from Grainfoot, East Lothian (Dalland, 1991) and the high-status female burial containing from Inchmarnock, Argyll and Bute (Marshall and Ferrier, 1963).

Not all unburnt human remains from the Early Bronze Age represent single burials of complete individuals. Brück (2004, 180) argued that there was a degree of continuity in the treatment of dead bodies from the Neolithic to the Bronze Age, as many Bronze Age burials represent commingled and fragmentary remains. The use of larger cists is an example of mortuary ritual that resembles the use of communal mortuary monuments during the Middle Neolithic. Like the Neolithic megalithic burials, some cists could be re-opened, to add or remove human remains (Brück, 2004, 2001). Examples include West Pinkerton Farm, East Lothian (Stevenson, 1939); Balbie Farm, Fife,(Piggott, 1948) and Traigh Bhan, Argyll and Bute (Ritchie and Stevenson, 1982). An exceptional case of Early Bronze Age multiple burial is that seen in the cist at Mill Road, West Lothian, which contained the commingled remains of five children and an adult, as well as small pieces of cremated remains. The cist was constructed so that it could be re-opened (Cook, 2000).

It cannot be completely ruled out that remains were kept elsewhere and placed in the grave when already skeletonised, especially as small bones, such as those from fingers and toes, may be missing (Ritchie and Stevenson, 1982, 553). A possible case is that of the Early Bronze Age cemetery of Barns Farm, Fife. On this site, extra teeth were found in two of the cists, suggesting the presence of disarticulated skulls. There were also three pits with teeth in them, which are also likely to have contained skulls (Watkins, 1982). Another interesting case is that of a cist excavated at Horsburgh Castle Farm, Borders, where a cist contained the disarticulated remains of a young adult. The analysis suggests that the remains were buried in a skeletonised or partly skeletonised state (Petersen et al., 1974, 46). There are also many cases of cremated remains being included in cists with unburnt individuals, these will be discussed below.

3.4.3 The Earlier Bronze Age: cremation ritual and technology

Earlier Bronze Age cremated remains from the Scottish Mainland are generally well calcined (Medina-Pettersson, 2008). Early archaeologists, working in the first half of the 20th century, were impressed with the mastery of the cremation process in Bronze Age societies (e.g. Fairbairn, 1924; Low, 1944). More recently, the nature of the remains have been used as an indication of whether bodies were fleshed or not when placed on the pyre (e.g. Mercer and Midgley, 1997; Johnson and Cameron, 2013). The interpretation of calcination patterns, including poorly burnt hand- and foot bones as well as vertebrae, has been used to suggest that individuals were placed on the pyre lying on their backs, which fits with most accounts of pyre cremation (e.g. Smith, 1995; Mercer and Midgley, 1997). However, some bodies may have been cremated in a crouched position, similar to the placing of bodies in inhumation burials (e.g. Shepherd and Shepherd, 2001; Kilbride-Jones, 1936). Multiple burials occur, suggesting that more than one person may have been cremated together (McKinley, 1997; Medina-Pettersson, 2008).

The finds of bone pins and so-called bone toggles indicate that at least some bodies were cremated dressed in elaborate clothes or shrouds (Sheridan, 2007a, 175). Bone toggles are unique to cremation burials, which suggests that some aspect of the clothing of people put on the pyre was different to that of individuals buried unburned (Ritchie and Thornber, 1975, 17-18), or possibly different conditions of preservation.

Animal bones are sometimes found in cremation burials (e.g. Mercer and Midgley, 1997; MacGregor, 1998, 2003; Johnson and Cameron, 2013). It has been suggested that sheep/goats were considered more appropriate to be included in cremation burials, whereas pigs were considered appropriate for inhumation burial (MacGregor, 2003). Animal bones are not restricted to domestic animals; an un-urned burial of a child at Skilmafilly, Aberdeenshire contained the talons of a golden eagle (Johnson and Cameron, 2013, 42). Other pyre goods include flints, such as flakes and arrowheads (e.g. Callander and Bryce, 1921; Cressey and Sheridan, 2003); and bronzes, including awls (Callander, 1932, 401-402) and daggers (Sheridan, 2007a, 175-177). Bronze objects may not always have survived, and can sometimes be inferred from stains on the bones (McKinley, 1994a). Faience beads have also been found with cremation burials, probably representing necklaces worn by the dead (e.g. Shepherd and Shepherd, 2001). Most burials contain only a few beads (e.g. Ritchie and Adamson, 1981; Banks, 1995). It is therefore likely that some necklaces contained organic beads, which were destroyed on the pyre. Bone beads have been found in some burials (e.g. Callander, 1930).

The low weights of the remains found in cremation burials indicates that not all of the bone from the pyre site was buried (Medina-Pettersson, 2008, 52). The portable nature of cremated remains has suggested to some that the remains may have been divided among the mourners after cremation (Brück, 2004). As the cremated remains were placed in their final resting place, be it cists, organic containers or urns, unburnt objects were sometimes added to the burial. These grave goods include flints (e.g. Shepherd and Cowrie, 1977; Johnson and Cameron, 2013), as well as stone (e.g. Ritchie, 1920; Kirby, 2011) and bronze artefacts (e.g. Fairbairn, 1924).

3.4.4 The Earlier Bronze Age: un-urned cremation burial

The category of un-urned cremation deposits is a varied one. Un-urned cremation burial dates back at least to the Neolithic, when cremated remains were spread on the ground surface before being covered up. This custom continues into the Bronze Age, where layers of cremated remains can be found in cairns. Not all un-urned burials lacked container, and in some cases organic containers have been identified. In other cases, deposits seem to have been directly placed in pits. Some deposits are not burials, but rather redeposited pyre debris or pyre sites.

The earliest Scottish cremation burials are dated to the Late Neolithic. Earlier research linked Late Neolithic cremation burials to ceremonial sites (Ritchie and Ritchie, 1991, 58-60). However, newer excavations prove that they can be found on a variety of types of sites such as at the ring-mound at Midtown of Pitglassie, Aberdeenshire (Shepherd, 1996), the settlement and ritual complex at Beckton Farm, Dumfries and Galloway (Pollard, 1997) and the chambered cairn at Geirisclett, Western Isles (Dunwell et al., 2003). These sites generally contain small quantities of heavily worn fragments, resulting from the acts of spreading cremated remains directly on the ground surface or the redeposition of pyre debris. Some Neolithic sites show evidence of a complex sequences of rituals. The Courthill barrow in Ayrshire, excavated in 1872 contained a palisaded structure, which showed signs of burning, as well as a burnt layer with flint flakes, burnt bones and deer antler. The layer had been sealed with a layer of moss and bracken (Patrick, 1874). At the Neolithic mound at Boghead, Moray, it was suggested that bodies had been temporarily buried, until skeletonised, before being exhumed and cremated on site (Burl, 1984, 53-55). However, the theory builds partly upon the notion that bones burnt when defleshed would be more completely calcined and more fragmented, which is not supported by recent research (Fairgrieve, 2008, 52).

The practice of depositing cremated remains without containers continues into the Early Bronze Age. Most cremation cemeteries, whether flat cemeteries or cairns/mounds, include both urned and un-urned cremation burials. That there is no urn cannot be taken to mean that the remains were placed unprotected in the earth. However, detecting organic containers is dependent on good conditions and/or careful methods of excavation and recording. At the unenclosed cremation cemetery at Skilmafilly, Aberdeenshire, 18 of the 29 burials were un-urned. Some of the burials contained pyre debris, followed by a cremation deposit in an organic container. The pits might even have been lined with roughly woven baskets. Other graves contained no pyre debris at all (Johnson and Cameron, 2013, 12-15). An interesting parallel to the roughly woven baskets at Skilmafilly can be found in Bronze Age cremation burials from Orkney, where the presence of fibres suggests that material from the pyre was gathered in baskets before being deposited (Photos-Jones et al., 2007, 3). As will be seen below, containers seem to have been more common, or perhaps just more easily detectable, in cists containing both cremated and unburnt remains.

Some pits containing un-urned cremation burials were sealed with stones, either slabs or boulders. Examples include the Bronze Age cemetery at Lockerbie Academy, Dumfries and Galloway (Kirby, 2011); the kerbed cairn at Stoneyfield, Highland (Simpson, 1996); the flat cemetery at Carronbridge, Fife (Johnston, 1994); and a cremation cemetery at Grandtully, Perthshire (Simpson and Coles, 1990). A somewhat similar case was one of the cremation pits from the ring cairn at Cloburn Quarry, Lanarkshire, which had its sides lined with clay before being filled with a mix of cremated remains and pyre debris (Lelong and Pollard, 1998, 111). Other un-urned cremation burials seem to have been entirely unprotected, such as at a cairn at Stoneyburn Farm, Lanarkshire,(Banks, 1995) and one of the pits at the Bronze Age cemetery of Seafield West, Highland

(Cressey and Sheridan, 2003). At the enclosed cemetery at Ratho, Edinburgh, careful sampling in the pit containing the only un-urned cremation burial on the site did not reveal any evidence of an organic container (Smith, 1995, 92-93), emphasising that some remains really were placed directly into the ground.

Whether un-urned cremation burials in pits represent burials of a lower status than urned burials is impossible to say, especially as un-urned burials are so heterogenous, with some having been buried in various types of organic containers and others placed directly into the earth. Un-urned burials in pits were given the same range of pyre goods as urned burials, including flint artefacts (e.g. Simpson and Coles, 1990), faience beads (e.g. Banks, 1995), bronze (Lelong and Pollard, 1998, 122) bone and antler artefacts (e.g. Kirby, 2011; Johnson and Cameron, 2013) and animal bones (e.g. Johnson and Cameron, 2013). Bronze appears to be very rare with un-urned cremation burials in pits, which could be related to poor preservation. This author was unable to find a single case of bronze artefacts found in this type of burial. Even blue/green staining, interpreted as indicating the presence of copper alloys, seems to be very rare, and only one case was found, context 56 from the ring cairn at Cloburn Quarry, Lanarkshire (Lelong and Pollard, 1998, 122). This burial was associated with Food Vessel sherds, which does not seem to have represented a a container for the bones, as it appears to have been crushed as part of the mortuary ritual (Lelong and Pollard, 1998, 129). It cannot be ruled out that the low incidence of stains could be related to failure to mention them in the report or the final publication. Furthermore, soil staining can make it difficult to identify copper alloy staining, which might be another explanation. Both sexes and all ages, except infants, are represented in un-urned pit burials. Children have been found, such as at the flat cemetery at Skilmafilly, Aberdeenshire (Johnson and Cameron, 2013).

Cremated remains have been found associated with beakers, both complete vessels and fragments. Cases of vessels which were complete at the time of burial include a cist in the Dalladies long barrow, Aberdeenshire (Piggott, 1972); a pit in Harehope Cairn, Scottish Borders (Jobey, 1980) and a cist at the North Mains henge, Perthshire (Barclay, 1983). The evidence from the Neolithic chambered cairn at Achnacreebeag, Argyll and Bute, is quite different. On this site, small fragments of cremated bone, small, scattered sherds of Beaker pottery, jet disc-beads and flint were found in the chamber. The material was probably associated with the filling and blocking of the tomb, and the Beakers were deposited already fragmented (Ritchie, 1970, 36).

In comparison to beakers, food vessels are more commonly associated with cremation burials. They are also found in a greater variety of contexts. Several come from cists, such as at Hero's Cairn, Lanarkshire (Stevenson, 1976); Ballimenach, Argyll and Bute (MacLaren and Scott, 1962); Mains of Airlie, Perthshire (Coutts, 1964, 161); Altyre, Moray (Callander, 1932) and Hodgeton Farm, Angus (Coutts, 1964). Other cremation burials associated with food vessels come from pits, such as at the ring cairn at Cloburn Quarry, Lanarkshire (Lelong and Pollard, 1998). Yet others are from Neolithic chambered cairns, including a secondary burial from Ord North, Sutherland (Sharples, 1981) and a burial associated with the blocking of the entrance of the tomb at Brackley, Argyll and Bute (Scott, 1956).

There is a wealth of Earlier Bronze Age un-urned cremation burials found in short cists within cairns and mounds as well as in flat cemeteries. Some of these represent single burial, much like the typical inhumation burials of the period, and many of these have been spread inside the cist. Cremated remains found in Bronze Age cist burials in Scandinavia were often spread out in anatomical positions, with grave goods placed where they would have been placed on unburnt bodies (e.g. Goldhahn, 2009; Stig Sørensen, 2010). Whether this was the case with Scottish cist burials is not known. Generally, the quantities of bone found in them is small and seemingly scattered within the cist (e.g. Robertson and Blair, 1944; Ritchie and Thornber, 1975; Sherriff, 1983; Campbell and Ritchie, 1984; Sherriff, 1986). Nevertheless, some contain cremated remains found in heaps (e.g. Buchanan, 1922; MacLaren, 1969). Several of these burials are associated with unburnt flint knives, such as at Murton Farm, Angus (Sherriff, 1986); Baldardo Farm, Angus (Sherriff, 1983) and Glenreasdell Mains, Argyll and Bute (MacLaren, 1969). Although flint is the most common find, bronze also occurs. A cist found in Pitlessie, Fife contained green-stained bones, which suggested to the excavators that there had, at some point, been bronze present (Gordon, 1927, 264). Although most remains seem to represent adults, both children (Ritchie and Thornber, 1975, 18-19) and infants (Coutts, 1964, 158) are represented.

Other cists resemble the monuments of the Middle Neolithic, and contain the remains of more than one individual. In some cases it is likely that they represent collective burials, in which individuals were added over time. Others are more likely to represent multiple burial, meaning that two or more individuals were buried at the same time, with no later burials being added. Examples of likely collective burial in cists include a cist in a cairn at Beech Hill House, Perthshire, where the remains of two individuals had been placed in two distinct concentrations, suggesting two different depositions (Stevenson, 1995, 204). Another cist in the same cairn contained three or four individuals (Stevenson, 1995, 205), although there was no separate concentrations of bone, the relatively large number of individuals suggests that it represents a collective grave. Other examples of cists containing large quantities of bone include a cist at Patrickholm Sand Quarry, Lanarkshire (Harrison, 1949) and cist 6 at Barns Farm, Fife (Watkins, 1982, 69-70). A number of cist contain two individuals - an adult and a child or infant - apparently cremated and/or buried together including a cist in a chambered cairn at Dalineun, Argyll and Bute (Ritchie, 1972); a cist at Ury House, Aberdeenshire (Low, 1935) and three of the cists at Sketewan, Perth and Kinross (Mercer and Midgley, 1997).

Just as during the Neolithic, not all Early Bronze Age un-urned cremated remains are necessarily burials as such. There are several examples of layers of cremated remains, sometimes mingled with charcoal and artefacts, which seem to represent redeposited pyre debris spread out over the ground before being sealed with layers of other materials and eventually being covered by a cairn. Examples include cairns at Linburn Plantation, Ayrshire (Fairbairn, 1922, 128); Stoneyfield, Highland (Simpson, 1996); Cairnwell, Aberdeenshire (McSweeney, 1997a) and Cloburn Quarry, Lanarkshire (Lelong and Pollard, 1998). In some cases, the redeposited pyre debris has been deposited in specific pits, such as at the cairn at Marchhouse, Ayrshire (Fairbairn, 1924, 335-336). In some cases, the ground itself shows evidence of burning, indicating a pyre site. At Sketewan, Perth and Kinross, an impressive pyre site with stone foundations was central to the cairn. Archaeological evidence suggests that the pyre site was used at least twice, and quite probably more times (Mercer and Midgley, 1997, 292-293). However, most remains of pyre sites are less ostentatious (e.g. Mackenzie, 1908; Baird, 1917; Ritchie and Thornber, 1975; McSweeney, 1997a).

Although evidence of burning has a greater chance of surviving under a cairn or mound, it has also been found on flat cemeteries, associated with urns or cists. At Balbirnie, Fife, (Curle, 1918) and Brackmont Mill, Fife (Longworth et al., 1967), urns were found inverted over burnt layers, interpreted as pyre sites or other types of ritual burning associated with the mortuary ritual. At Kinneil Mill, Stirlingshire, a ring-ditched cremation cemetery contained a pit with pyre debris, described as an 'ash pit', as well as smaller areas with evidence of burning and small bone fragments, probably remains of pyre sites (Marriott, 1968, 88-89). An exceptional find is the central burial from the enclosed cremation cemetery at Loanhead of Daviot, Aberdeenshire. It consists of a pit with pyre debris and cremated remains, from in situ burning. The human remains were found in anatomical order, suggesting a crouched body (Kilbride-Jones, 1936, 282-283). In this case, the pyre site and burial are one and the same. It is possible that, as with some English sites of the Earlier Bronze Age, this rare burial represents a sort of bustum cremation site, in which the pyre was built over a pit, into which the pyre collapsed as it burned (Dodwell, 2012).

More complex evidence of various stages of the mortuary ritual were found in two excavated sites in the Scottish Borders: Weird Law enclosed cremation cemetery and Broughton Knowe barrow. At Weird Law, the excavators (not the osteologist) interpreted the evidence as indicating a longer ritual process related to the treatment of the corpses. First, the bodies were buried temporarily, while the mourners prepared the pyre. The bodies were then dug up and cremated on the site, before the bones were gathered in bags and buried. Afterwards, the pyre debris was gathered and buried separately in other pits (MacLaren, 1967, 96). At Broughton Knowe, the central area had been severely disturbed, and only small quantities of cremated bone were found on the old ground surface. The excavators suggested that a temporary cover such as a tent had been erected after making the ditch around the site and prior to the raising of the barrow, perhaps for holding the corpse on a platform inside. The cremation had taken place elsewhere and the bones were spread over the ancient ground surface together with flint scrapers and scattered pottery before raising the barrow (MacLaren, 1967, 102-103). A case of partial cremation was suggested at Knappers, Dunbartonshire, originally excavated in the 1930s. One burial was allegedly partly cremated, with the cranium being 'incinerated' and the rest of the body buried nearby, unburnt (Ritchie and Adamson, 1981, 175). It should be noted that similar cases of partial cremation identified by early archaeologists have been discredited by later research, such as at the Hallstatt Iron Age cemetery in Austria (Rebay-Salisbury, 2010).

3.4.5 The Earlier Bronze Age: combined cremation- and inhumation burials in cists

This is an interesting group of burials, which consists of cists or coffins in which an unburnt body has apparently been accompanied by one or more deposits of cremated remains, often placed in some sort of container. In some cases, both burials seem to have been placed simultaneously in the grave, whereas in other cases it is clear that the cremated remains have been added later.

The earliest recorded excavation of such a grave is from outside the study area of this thesis, from a short cist excavated at Skaill, Orkney, in 1772 (Lysaght, 1972). It comprised of a crouched inhumation with a quantity of cremated remains at its feet. Compared to later excavations, the level of organic preservation was good, meaning that the leather bag in which the cremated remains were placed survived. Although such combination burials are unusual, they have been known for a long time. In 1870, Neish (1870, 382-383), documenting the discovery of a cist on which urns had been placed, asked a Reverend William Greenwell of Durham if he thought the inhumation in the cist and the cremation burials were contemporary, to which Greenwell replied that he had seen many combined inhumation and cremation burials in cists, and believed them to be contemporary. Bronze Age cist or coffin burials containing inhumation burials accompanied by cremation burials are not unique to Scotland. A famous example is the well-preserved coffin burial of a young woman found in a mound in Egtved, Denmark, which also contained the cremated remains of a 6-7 year old child, placed in a container under the woman's head (Goldhahn, 2009, 70-71).

Most cist burials of cremated and unburnt remains occurring together are associated with food vessels and beakers, dating them to the Early Bronze Age. Examples with food vessels include cist 7 at West Water Reservoir, Scottish Borders (Hunter, 2000); burial D at North Mains, Perthshire (Barclay, 1989); graves 1 and 2 at Barns Farm, Fife (these were not cists, but wooden coffins) (Watkins, 1982); a cist found at Camelon, Falkirk (Buchanan and Callander, 1923) and cist 9 in a cairn at Balnabraid, Argyll and Bute (Galloway, 1920b). Burials associated with beakers are fewer, and include the cist from the cist cemetery of Doons Law, Scottish Borders (Clarke and Hamilton, 1999) and a cist excavated at Dornoch Nursery, Sutherland (Ashmore, 1989). There are also cases of burials not associated with pottery, including the cist found at the stone circle at Crichie, Aberdeenshire (Ritchie, 1920) and a cist found in a mound at Cavers, Borders (Christison, 1897). However, not all cists with a combination of cremated and unburnt remains belong to the Bronze Age. One of two cists excavated at Golspie, Sutherland, contained an inhumation with a small quantity of burnt bone and charcoal. The other finds in the cists, as well as the unusual construction of the cist, dated it to the Iron Age (Woodham and Mackenzie, 1957).

Brück (2004, 180) suggested that the positioning of cremated remains around an unburnt individual resembled the placement of grave goods, indicating a cosmology in which the fragmentation of human bodies was acceptable, as during the Neolithic. The grave that Brück (2004) discussed, Grave 1 at Barns Farm, Fife, is a wooden coffin containing the unburnt, flexed body of a young adult as well as three deposits of cremated remains, placed around the unburnt individual. Cremation burial 1, lying by the back of the inhumation, belonged to a child, aged 6-8. The way in which it was spread suggested that it had not been placed in a container. Cremation burial 2, placed over the forearms of the crouched inhumation, belonged to a possible female, aged at least 18-20. Contrary to the first cremation burial, this did seem to have been placed in a bag or basket. Cremation burial 3, a juvenile, was placed across the coffin, beyond the head of the inhumation. It seemed to have been placed in a box or trough. The evidence seemed to suggest that all of the burials had been deposited in the coffin at the same time (Watkins, 1982, 72-74). Grave 2 at Barns Farm contained a crouched inhumation accompanied by cremated remains, which had been placed in a corner of the coffin in a sack or bag. Similar to Grave 1, both burials seemed to have been deposited at the same time (Watkins, 1982, 74-75).

This is not always the case. At the flat cist cemetery at West Water Reservoir, Scottish Borders, cist 7 contained the unburnt remains of an adult of unknown age accompanied by a thin spread of cremated remains from a probable male, aged 17-19. The inhumation burial had been disturbed after it had become skeletonised, suggesting that the cist had been reopened to insert the cremation burial at the foot end. The lack of evidence of a recut suggests that the cist was not backfilled until the cremation burial was inserted, and that it was always the intention to reopen it (Hunter, 2000, 128). In many cases, there is no mention of whether the cremated and unburnt remains were buried at the same time, or whether one was inserted later. There does not seem to be any distinct rules about how to place the cremated remains in the grave. Cremated remains occur as spreads, apparently without container, such as in the cases of cist 7 at West Water Reservoir, Scottish Borders (Hunter, 2000); cremation burial 1 in Grave 1 at Barns Farm, Fife (Watkins, 1982) and Cavers, Borders (Christison, 1897). In other cases, the remains seem to have been placed in containers, such as bags or troughs. Examples include Burial D at North Mains, Perthshire (Barclay, 1989), as well as cremation burials 2 and 3 from Grave 1 and the cremation burial from Grave 2 at Barns Farm, Fife (Watkins, 1982).

3.4.6 The Earlier Bronze Age: urned cremation burial

Urned cremation burial first occurred on the British Isles towards the end of the third millennium BC, and the tradition continued into the Later Bronze Age. They are found in a variety of contexts, ranging from single urns to cemeteries, either flat or in cairns and mounds. Although most urns contain a single individual, a significant minority contain two or three individuals. Although all ages and both sexes are represented, juveniles are more commonly found in multiple burials than in single ones, and males might be more common than females, especially in single burials.

Some cremation burials of the Early Bronze Age differ from earlier cremation traditions. These are the burials of cremated remains in cinerary urns of different types. On the British Isles, this custom is first seen in the early use of Collared Urns in southern England, around the end of the third millennium BC (Sheridan, 2004a, 260). As a Bronze Age phenomenon, urn burial is most commonly associated with the Late Bronze Age Urnfield Culture of central Europe, a tradition which supposedly traces its roots to the early use of urns in the Vatya culture of the Carpathian Basin from c. 1950 BC (Rebay-Salisbury and Stig Sørensen, 2008b). This date is later than the earliest British urned cremation burials.

The great majority of Scottish urned cremation burials are dated to the Earlier Bronze Age, although some date to the Later Bronze Age and beyond (see below). The earliest cinerary urns found in Scotland are Vase Urns, which occur between c. 2200-1700 BC. These are followed by Collared Urns, c. 2000-1600 BC and Cordoned Urns, c. 1800-1400 BC (Sheridan, 2004a, 261). While Vase Urns and Collared Urns occur throughout the British Isles (Gibson and Woods, 1997, 127-129), Cordoned Urns represent an Irish/Scottish variation on Collared Urns (Sheridan, 2004a, 259). Although generally containing cremated remains, Collared Urns have been found without human remains (Longworth, 1984), but still associated with ritual activity involving fire (Masser and MacSween, 2002). The less ornamented Bucket Urns have a much wider date range, from c. 1900-700 BC, and are the only urns which continue in use into the Later Bronze Age (Sheridan, 2007a, 169). The wide range of dates for Bucket Urns makes it difficult to know whether they represent a single phenomenon, or whether the label represents a catch-all term, encompassing various local traditions of simpler, less ornamented urns (Sheridan, 2007a, 170).

At least in some cases, urns were not made specifically for housing the cremated remains. The urn from a single burial at Benderloch, Argyll and Bute, had seen previous use, perhaps for cooking (MacGregor, 1998, 147). Unlike organic containers, ceramic urns protect the bones inside from the surrounding soil. Pollen data indicating the presence of moss inside an urn (Smith, 1995, 88) enforces the notion that protection of the bones from further fragmentation was important, and that the bones were handled with care. The urns can be quite large, meaning that the bones did not have to be crushed to fit inside (Shepherd and Shepherd, 2001, 109-110). In some cases, there seem to have been additional, organic, containers around the urn (e.g. Smith, 1872). Where preservation is good, remains of organic seals or lids have been found (Shepherd and Shepherd, 2001, 104); there are also cases of urns being sealed with soft clay (e.g. Mann, 1906). Inversion seems to have been the norm, but when the urn is not inverted, lids, including flat stones, have been found (e.g. Stevenson, 1939). Sometimes, urns were placed in pits which already contained the pyre debris (e.g. Jervise, 1866; Curle, 1918; Stevenson, 1939). Alternatively, the pyre debris could be inserted afterwards, over the urn (e.g. Shepherd and Shepherd, 2001).

Urned cremation burials are found in a variety of contexts, ranging from single urns to cemeteries, either flat or in cairns or mounds. It is worth noting that in cemeteries, there tends to be a mixture between urned and un-urned cremation burials, with un-urned burials sometimes outnumbering the urned ones. At the cemetery of Skilmafilly, Aberdeenshire, extensive dating was carried out, which confirmed that both urned and un-urned burial occurred at the same time (Johnson and Cameron, 2013, 40-41). In the past, single urns were often found during agricultural work. As these early finds rarely led to further excavation, it is difficult to know whether it was genuinely a case of a single urn, or whether the urn was part of a cemetery. Single urns discovered and excavated more recently confirms that urns were sometimes deposited on their own, not in connection with other graves. Examples include the urn from a boulder shelter at Glennan, Argyll and Bute (MacGregor, 2003), the urn from 102 Findhorn, Moray (Shepherd and Shepherd, 2001) and the urn from Benderloch, Argyll and Bute (MacGregor, 1998). The Glennan urn contained an adult male with sheep/goat bones, whereas both of the other urns contained adult females with infants, a neonate in the case of the Findhorn burial, and an infant under the age of four at Benderloch. The Findhorn burial was further remarkable in containing a faience necklace of 22 beads. It is not known why these individuals were buried apart from others in their community.

Flat cemeteries, either cist cemeteries or those containing cremation burials without cists are widely occurring. In landscapes which have long been used for agriculture, it may be difficult to know whether a site is genuinely a flat cemetery, or if there was once a mound (e.g. Watkins, 1982). There is some geographical variation in the patterning of cremation cemeteries, such as the linear cremation cemeteries seen in Fife, examples of which include Carphin House (Lawson, 1868, 404-406) and Brackmont Mill (Mears, 1936). It has been argued that enclosed cremation cemeteries are more common in the south (Sheridan, 2004a, 261), and examples such as Weird Law, Scottish Borders (MacLaren, 1967), Kinneil Mill, Stirling (Marriott, 1968), Camps Reservoir, Lanarkshire (Ward, 1994), Ratho, Edinburgh (Smith, 1995), and Cloburn Quarry, Lanarkshire (Lelong and Pollard, 1998) are good examples of this type of site. It should be noted that some of these, such as Weird Law and Camps Reservoir, comprised only un-urned cremation burials, and Cloburn Quarry only one urned burial and several un-urned ones. However, examples of enclosed cemeteries also occur in the north-east, such as the cemetery at Loanhead of Daviot, Aberdeenshire (Kilbride-Jones, 1936).

Un-enclosed cremation cemeteries occur more widely, with examples from north-eastern Scotland, such as Seafield West, Highlands (Cressey and Sheridan, 2003) and Skilmafilly, Aberdeenshire (Johnson and Cameron, 2013); as well as from further south, including Cowdenbeath, Fife (Lacaille, 1931); Monkton, Ayrshire (Webster, 1944); Glenluce Sands, Dumfries and Galloway (Davidson, 1952); Kirkburn, Dumfries and Galloway (Cormack, 1963); Ferniegair, Lanarkshire (Welfare, 1975), and Grandtully, Perthshire (Simpson and Coles, 1990). The size of flat cemeteries vary widely. Some sites contain large amounts of burials, such as the Brackmont Mill sand quarry, which produced some thirty cremation burials over the years, many of them urned (e.g. Mears, 1936; Childe and Waterston, 1942; Spence, 1949; Longworth et al., 1967), or the more recently excavated cemetery at Skilmafilly, which contained 29 burials, 11 of them urned (Johnson and Cameron, 2013). Others, such as the cemetery at Glenluce Sands, contained only two burials (Davidson, 1952). Flat cemeteries containing mainly cists are rarer than flat cemeteries containing mainly urned and un-urned cremation burials. A relatively recently published cist cemetery is the one from West Water Reservoir, Scottish Borders (Hunter, 2000), which contained nine cists, containing both inhumation burials and cremation burials, occasionally in the same cist. The cist cemetery at Aberdour Road, Fife, contained six cists. Like the West Water Reservoir cemetery, it contained both inhumation and cremation burials (Close-Brooks et al., 1972).

Urns are frequently found in cairns and mounds, often dating to the later stages of use (e.g. Lelong and Pollard, 1998; Mercer and Midgley, 1997). Although large numbers of cremation burials can be found in cairns and mounds, these monuments rarely contain the number of urned burials found on some of the flat cemeteries mentioned above. Indeed, it seems as if cairns or mounds rarely contain more than a couple of urned burials. At the ring-cairn at Cloburn Quarry, Lanarkshire, only one out of c. 17 cremation burials was urned (Lelong and Pollard, 1998). At the ring-cairn at Sketewan, Perth and Kinross, only two out of at least 13 cremation burials were urned (Mercer and Midgley, 1997). At the kerbed cairn at Stoneyfield, Highland, one urned cremation, representing the latest phase of activity, was excavated, together with at least two un-urned cremation burial in pits. The several cists on the site seem to have contained inhumation burials (Simpson, 1996). At Harehope Cairn, Scottish Borders, two of the seven cremation burials were associated with urns (Jobey, 1980). At the so-called Gallows Hill mound at Easter Culbeuchly, Aberdeenshire, at least five urns were found. Unfortunately, the site was removed before it could be properly excavated (Wallace and Walker, 1961). The mound at Blair Drummond, Perth and Kinross contained two cists, one of which contained an urned cremation burial (Callander, 1929). At an oval cairn at Balnabraid, Argyll and Bute, 12 cists were found. Two of these contained urned cremation burials, whereas the others contained un-urned cremation burials or very poorly preserved inhumation burials (Galloway, 1920b).

Bronze Age cremation burials tend to contain the remains a single individual, but in some cases two or more individuals can be represented (McKinley, 1997). Multiple individuals are rarer in urns than they are in cists (Medina-Pettersson, 2008, 43-44), but urns containing both two and three individuals have been found (e.g. Simpson and Coles, 1990; Lockhart, 1972). Most of these burials contain children, and although some contain more than one child, most contain pairings of children or infants together with an adult. Examples of children found together include Burial 003 from the flat cemetery at Skilmafilly, Aberdeenshire (Johnson and Cameron, 2013) and one of the urns from the flat cemetery at Grandtully, Perthshire (Simpson and Coles, 1990). Burials containing an adult and one or more juveniles include the single burial from Findhorn, Moray (Shepherd and Shepherd, 2001); a burial from Cloburn Quarry, Lanarkshire (Lelong and Pollard, 1998, 117-118); a burial from Benderloch, Argyll (MacGregor, 1998); cremation C at Harehope Cairn, Scottish Borders (Jobey, 1980); a burial from Kiltry Knock, Aberdeenshire (Shepherd and Cowrie, 1977); a burial from Howford Farm, Aberdeenshire (Lockhart, 1972) and a burial from Wester Bucklyvie, Fife (Smith, 1872). In most cases, the adult has been sexed as a female. In some cases, stray bones of an adult have been found in burials containing children, such as in burials 003 and 021 from Skilmafilly, Aberdeenshire (Johnson and Cameron, 2013). Paired adults are the most uncommon combination, but one example is urn 3 from Kinneil Mill, Stirling, which seems to have contained two adult females (Marriott, 1968).

As seen, children are often present in multiple burials. However, even young children and infants could be buried on their own. Apparently, this did not always equate being buried in an urn. At Skilmafilly, no single juveniles were found in the urned burials, whereas at least four juveniles were present as single burials among the un-urned burials (Johnson and Cameron, 2013). At Sketewan, one of the only two urned burials on the site was a child of 2-5 years (Mercer and Midgley, 1997, 301). At Stoneyfield, the only urned cremation was that of a child aged 2-3 years (Simpson, 1996). At Harehope Cairn, one of the two urned cremation burials was that of a 3-4 year old child (Simpson, 1996). At Low Glengyre, Dumfries and Galloway, a single flat grave contained the remains of a child of 8-12 years (Mann, 1923). At the flat cemetery of Seggiecrook, Aberdeenshire, one of the four urns contained the remains of a child, c. 3-12 years old (Callander, 1908). A single urn found at Murthly, Perth and Kinross, seems to have contained the remains of a child (Mitchell, 1872).

As mentioned previously, it is generally more difficult to establish the sex than the age of cremated remains. This means that many of the remains from the relatively few urned cremation burials which have been osteologically analysed are of unknown sex. However, newer excavation reports often feature estimations of the sex of the individuals, and in some cases, even older excavations contain reliable osteological reports. Male and probable male burials include burials 013, 034 and 044 from Skilmafilly, Aberdeenshire (Johnson and Cameron, 2013); F35 from Lockerbie Academy Dumfries and Galloway (Kirby, 2011); a burial from Glennan, Argyll and Bute (MacGregor, 2003); two urns from Ratho, Edinburgh (Smith, 1995); pit 16 from Grandtully, Perthshire (Simpson and Coles, 1990); urns 1 and 2 from Kinneil Mill, Stirlingshire (Marriott, 1968) and an urn found at Kirklands, Ayrshire (Edwards, 1936). Female burials include burial 030 from Skilmafilly (Johnson and Cameron, 2013); pit 7 from Seafield West, Highlands (Cressey and Sheridan, 2003); one of the urns from Monklaw, Scottish Borders (Edwards, 1934) and an urn found at Toxside Wood, Midlothian, (Callander, 1932, 401-402). It would seem from this that male burials are slightly more common than female ones, although this might just reflect a bias in the methods for sexing remains, or be a result of the small number of sexed individuals.

3.4.7 The Later Bronze Age

Mortuary ritual during the Later Bronze Age differs from that of the Earlier Bronze Age. Burial becomes rarer in the archaeological record, and much of the evidence for Scotland comes from the Western and Northern Isles. There is evidence of both inhumation and cremation burial, although rarely of complete bodies. Unburnt human remains are found in connection with settlements and on ‘special’ places, including wet places and caves. Both urned and un-urned cremations are found in these locations. The urned burials are often associated with henges and other monuments of the Earlier Bronze Age. The Bucket Urns, together with the Northern Isles Urns found on Shetland and Orkney, are the only type of urns that survive into the Later Bronze Age.

The Later Bronze Age saw a change in society, and the discontinuation of many of the mortuary traditions associated with the Earlier Bronze Age. Later Bronze Age burial has more in common with Iron Age traditions, and several of the trends beginning during the Later Bronze Age continue into the Iron Age. Mortuary treatment in the Earlier Bronze Age is generally better-known than in the Later Bronze Age. This holds true for Scotland as well as for the rest of Britain. However, an increasing number of Scottish Later Bronze Age burials are being identified. Of these, most are found outside Mainland Scotland, on the Western and Northern Isles. Due to the rarity of Later Bronze Age burials, they are still worthy of mention.

In Britain as a whole, two main trends can be identified for human remains in the Later Bronze Age. Firstly, they may be found in association with settlements, such as near houses or middens or in hillforts (Simpson et al., 2003, 186). Secondly, they may be found deposited together with prestigious metalwork in 'special' places, including caves and wet places (Shepherd, 2007, 201). However, some trends of the Earlier Bronze Age appear to continue into the Later Bronze Age, although they seem to have become much rarer. These include urned cremation burials in cairns (Cook, 1999), but also in Earlier Bronze Age henges (Childe, 1934).

Examples of human remains associated with settlements include burials in middens as well as under roundhouses. At Manish Strand, Western Isles, two crouched burials of Late Bronze Age date were buried in graves dug into an Early Bronze Age midden, one of them possibly associated with pottery (Simpson et al., 2003). Two similar Late Bronze Age burials have been found on the nearby site of Norton (Simpson et al., 2003, 186). At Cladh Hallan, Western Isles, four burials, representing an adult male, an adult female and two children, dating to the transition between the Earlier and Later Bronze Age, had been buried underneath the floors of two of the roundhouses during the Later Bronze Age. The excavators suggested that the bodies had been curated, and were buried several hundred years after they died. Furthermore, two of the skeletons had been modified after death. The male skeleton was discovered to be a composite of three individuals, and the female one had had some of her teeth removed and placed in her hands (Parker Pearson et al., 2005, 2007). These examples all represent more or less complete bodies. However, more often than not, the human remains found on settlements are disarticulated and fragmented (Brück, 1995), a trend that continues into the Iron Age (Hinley, 1992, 16).

Human remains deposited in special locations, including wet locations (such as bogs or bodies of water) and caves constitute the second category of sites associated with human remains. A notable case is that of Sculptor's Cave, Covesea, Moray (Shepherd, 2007). The 1930s excavations revealed human remains, particularly mandibles. Metal, including ring money and armlet fragments, was also found. Although both adults and non-adults were present among the remains, non-adult remains were overrepresented. It was interpreted as a liminal place drawing people from a wide area, who came there to deposit fine metalwork and human remains. The large quantities of skull fragments might suggest that skulls were displayed inside the cave. Another important Scottish site is Duddingston Loch near Edinburgh, where a hoard was found in 1778. The bronzes included spearheads, daggers and rapiers and the ring of a cauldron. With these were found horns of deer and elk as well as skulls and other human bones (Callander, 1922, 360-362). Similar places with finds of metalwork and fragmented human remains are found in other places in Britain, including Soar (Ripper and Beamish, 2012) and Flag Fen (Pryor, 2005) in England. The trend of human remains in 'special' locations continues into the Iron Age (e.g. Hallen and Saville, 1994).

The paucity of formal Late Bronze Age burials suggests that the disposal of the dead during this period involved methods which cannot be archaeologically identified. One possibility is cremation followed by scattering of the ashes. Archaeologically visible traditions of cremation, much like any type of burial, become very rare during the Later Bronze Age. Of the mainland cremation traditions involving urns, only Bucket Urns continue into the 1st millennium BC. On Shetland and Orkney, Northern Isles Urns have been radiocarbon dated to the 1st millennium BC and later (Sheridan, 2007a, 172).

As mentioned above, it is uncertain whether the Bucket Urns represent an unbroken tradition, or several different local traditions. Seven of the thirteen Bucket Urn burials dated through the NHS's Dating Cremated Bones Project gave date ranges which fell into the Later Bronze Age (Sheridan, 2007a, 171). These include the central cist of a cairn Gownie, Aberdeenshire (Anderson, 1891); the centre of a stone circle at Sandy Road, Perth and Kinross (Coles, 1909); one of the pits in the centre of a stone circle at Garrol Wood, Aberdeenshire (Coles, 1905); the centre of a stone circle at Old Keig, Aberdeenshire (Childe, 1934); a henge or barrow at Foularton, Aberdeenshire (Harding and Lee, 1987, 357) and two burials from two cairns at Sanaighmor Warren, Islay (Cook, 1999).

Three of these burials are from stone circles, one from a henge and one from a cairn, which points to the reuse of older, Earlier Bronze Age funerary and ceremonial sites, at least in the Aberdeenshire area. The fact that these burials are relatively rare, and often centrally placed, suggests a special role of cremation burials in urns during this period. The mortuary ritual associated with these urns is very poorly understood, as the only urned remains radiocarbon dated to the Later Bronze Age are the Sanaighmor Warren burials. These represented a young adult, possibly female, and an individual of c. 10-30 years of unknown sex. Both deposits were in a relatively poor condition, and do not seem to have been associated with identifiable pyre goods (Cook, 1999).

Not all cremation burials found in henges were found in urns. In a henge at North Mains, Strathallan, Perthshire, unurned cremation burials and pyre sites dating to the Later Bronze Age were found (Barclay, 1983). There are also flat cremation cemeteries dated to the period. At Cladh Hallan, a Later Bronze Age cremation cemetery was found, consisting of spreads of cremated juvenile remains, peat soot and small beach pebbles. One of the burials was found under a roundhouse, two other deposits were surrounded by rings of stone, and a further three ones were completely unmarked (Parker Pearson and Mulville, 2002).

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Chapter 4

Material and Methods

4.1 The osteological material

The osteological material analysed for this thesis consists of a sample of 75 urned cremation burials from the Scottish mainland. The sites are presented in Table 4.1 and plotted on the map in Figure 4.1. The burials were selected from the collections of The National Museums Scotland (NMS), with the help of Dr Alison Sheridan, Principal Curator of Early Prehistory. The only exceptions were the two cremation burials from Glenluce Sands, which were there on loan to the NMS for radiocarbon dating. The majority of the burials analysed had not been osteologically analysed.

A number of criteria were used to select the material. Firstly, deposits had to be of a reasonable size for analysis. A few deposits were rejected due to containing only extremely small quantities of bone (less than 10 g), and for containing no bone fragments which were identifiable. Secondly, deposits that had been radiocarbon dated were given priority, even if they had been analysed before.

The 75 deposits analysed should be representative of the c. 110 urned cremation burials from the Scottish mainland kept at the National Museum stores. The exact number of urned cremation burials in the museum collection is an estimate. The reasons for this is that the latest catalogue of Late Neolithic/Early Bronze Age human remains in the museum collections is from 2003, which leaves out any newer acquisitions. It is also possible that some older burials have acci-

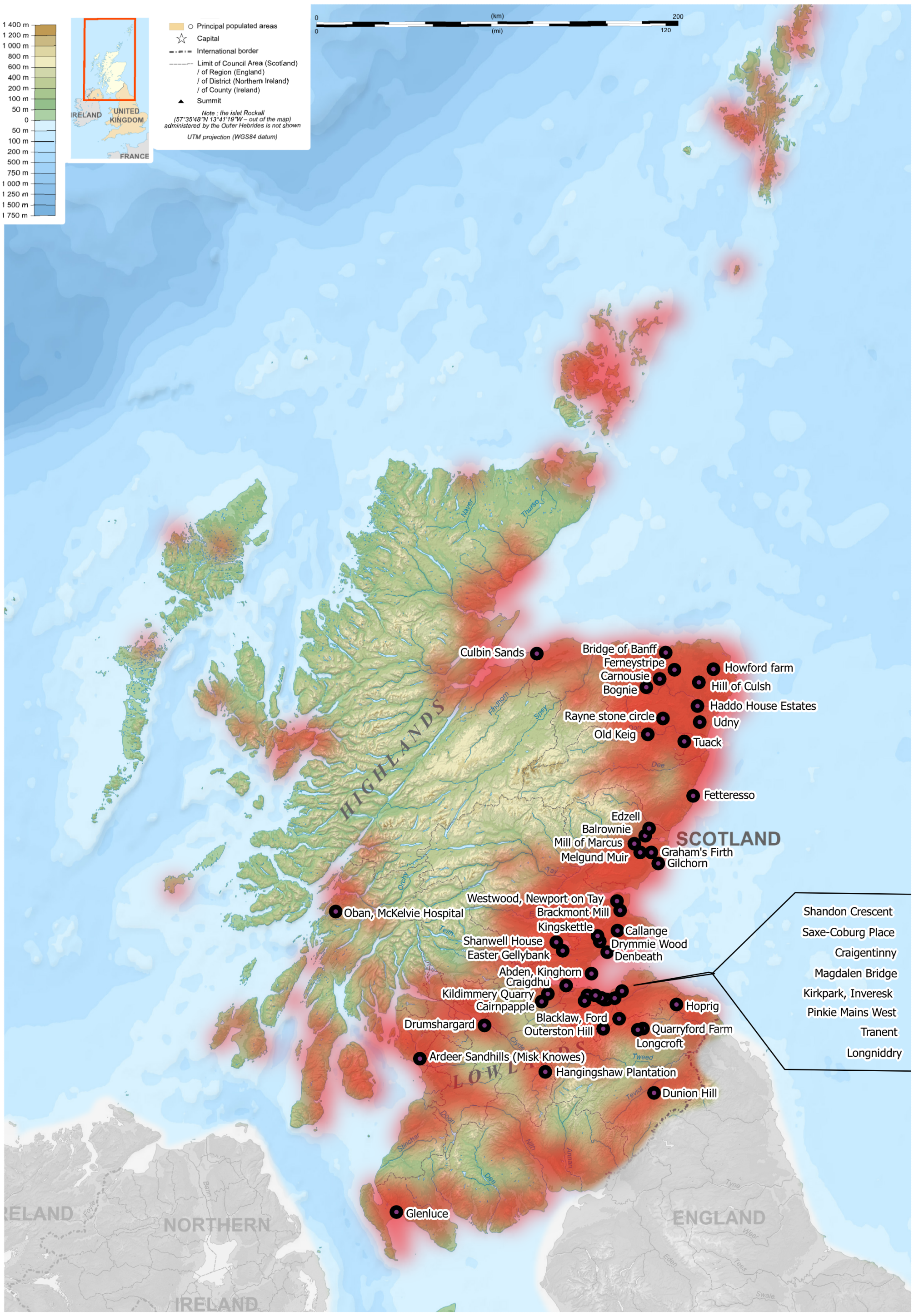

Figure 4.1: Names and locations of the sites included for study are indicated by dots on the map. The red areas show the distribution of c. 900 possible BA urned cremation sites. Map of Scotland courtesy of Wikipedia contributor Eric Gaba (username: Sting), available from `http://commons.wikimedia.org/wiki/File:Scotland_topographic_map-en.svg`

Local authority	Site name	Deposits
Aberdeenshire	Bognie	2
Aberdeenshire	Bridge of Banff	1
Aberdeenshire	Carnousie	1
Aberdeenshire	Ferneystripe	1
Aberdeenshire	Fetteresso	1
Aberdeenshire	Haddo House Estates	2
Aberdeenshire	Hill of Culsh	1
Aberdeenshire	Howford Farm	2
Aberdeenshire	Old Keig	1
Aberdeenshire	Outerston Hill	1
Aberdeenshire	Rayne stone circle	1
Aberdeenshire	Tuack	2
Aberdeenshire	Udny	1
Angus	Balrownie	2
Angus	Edzell	1
Angus	Gilchorn	2
Angus	Graham's Firth	1
Angus	Melgund Muir	1
Angus	Mill of Marcus	1
Argyll and Bute	Oban,McKelvie Hospital	1
Ayrshire	Ardeer Sandhills (Misk Knowes)	1
Dumfries and Galloway	Glenluce	2
East Lothian	Kirkpark,Inveresk	6
East Lothian	Longniddry	4
East Lothian	Pinkie Mains West	1
East Lothian	Quarryford Farm	1
East Lothian	Tranent	1
Edinburgh,City of	Craigentinny	1
Edinburgh,City of	Magdalen Bridge	4
Edinburgh,City of	Saxe-Coburg Place	1
Edinburgh,City of	Shandon Crescent	1
Fife	Abden,Kinghorn	1
Fife	Brackmont Mill	3
Fife	Callange	1
Fife	Craigdhu	1
Fife	Denbeath	1
Fife	Drymmie Wood	3
Fife	Kingskettle	3
Fife	Westwood,Newport on Tay	1
Midlothian	Blacklaw,Ford	1
Midlothian	Hangingshaw Plantation	1
Moray	Culbin Sands	2
Perth and Kinross	Drumshargard	1
Perth and Kinross	Easter Gellybank	1
Perth and Kinross	Shanwell House	1
Scottish Borders	Dunion Hill	1
Scottish Borders	Hoprig	1
Scottish Borders	Longcroft	1
West Lothian	Cairnpapple	1
West Lothian	Kildimmery Quarry	1
		75

Table 4.1: Sites and deposits within the study area.

dentally been left out. Furthermore, some deposits mentioned in the catalogue could not be located in the stores.

It is not possible to know how many Bronze Age urned cremation burials there are in total on the Scottish mainland. Entering the term 'urn' into Canmore (The Royal Commission for Ancient and Historic Monuments of Scotland's (RCAHMS) database of archaeological sites) yielded nearly 900 sites for all of Scotland in November 2010. Many of these sites contained more than one urn. The search returns a small number of later sites, but the vast majority of the sites belong to the Bronze Age. This number should be considered a rough estimate, but suggests that about 5% of Scottish Bronze Age sites containing urned cremations have been sampled in this thesis. Figure 4.2 shows the material.

The deposits were originally excavated between the early nineteenth century and the 1980s, with the majority having been excavated from the middle of the nineteenth century to the middle of the twentieth century. Geographically, most deposits in the sample are from East and Central Scotland. The reasons for this are twofold. Firstly, these areas are more densely populated than other areas of Scotland, leading to more excavations and accidental discoveries. Due to the arable soils, it is also likely that they would have been more densely populated than less fertile areas in the past. The amount of excavated urned cremations from these areas is greater than elsewhere. Secondly, it reflects a regional bias to the collections of the NMS, as many cremation burials from Western and Northern Scotland are held by other museums.

Many of the analysed deposits were excavated in the nineteenth century or early twentieth century, meaning that the excavation methods and documentation practices are lacking compared to newer excavations. For this reason, it can be problematic to compare nineteenth century excavations with those from the mid-twentieth century, or later. Furthermore, because some burials were excavated a long time ago, their level of preservation may have suffered, due to careless handling or improper storage. This is especially the case for cremation burials which have been moved between different institutions, and those that have been donated to the NMS from individuals. The quality and level of preservation varies between cremation burials. This is due to soil conditions, protection (such as urns or cists), as well as excavation practices and how the

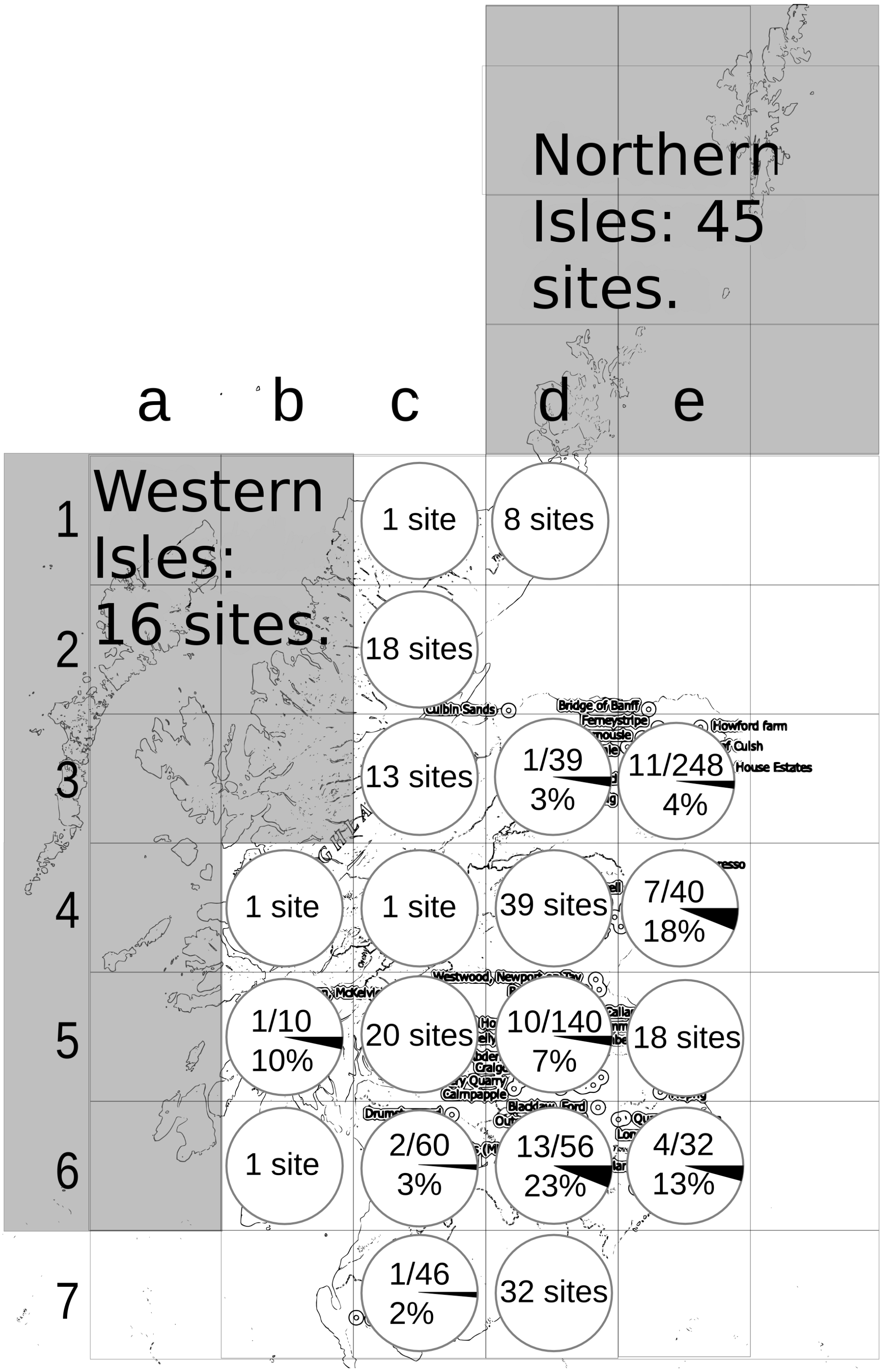

Figure 4.2: The pie charts show estimated coverage of the selected material for different geographical areas. Map showing analysed sites and total number of sites per grid square. Where only one figure is stated, no sites were analysed from that square.

remains have been kept and handled since excavation. All of these factors affect the amount of information that can be gained from the cremation burials. Sometimes, not all burials from a site have survived, such as in the cases of Magdalen Bridge (Lowson, 1882) and Kirkpark (Anderson, 1894).

The dates of the material span the Early Bronze Age to the Late Bronze Age, with the majority dating to the Early or Middle Bronze Age. 19 of the burials have been radiocarbon dated through the museum's Dating Cremated Bones Project (Sheridan, 2002, 2003b, 2004b, 2005, 2006, 2007c, 2008a). A further 44 could be typologically dated, based on the typology of the urn. 11 of the burials came from urns which could not be classed, either because of poor preservation or because they were not distinct enough. These could only be classed as Bronze Age.

4.2 Methods used to analyse the material

Despite the fact that studies of cremated remains were carried out in several countries during the first half of the 20th century, most were published in local journals in a variety of languages (Gejvall, 1963, 380). This meant that there was not much contact and exchange of ideas, and a lack of standard methods for analysing and recording cremated remains. In recent years there has been calls for increasing collaboration and standardisation of methods of analysis and recording throughout the field of osteology. Lange et al. (1987) suggested a standard way to analyse and record cremation burials. In Britain, the methods of McKinley (1994c), first developed to analyse the material from the Spong Hill cremation cemetery served as the basis for the methods used in the Guidelines to the Standards for Recording Human Remains (McKinley, 2004). In the United States, the Standards for Data Collection from Human Skeletal Remains (Ubelaker and Buikstra, 1994) provides a template for recording data pertaining to cremated remains.

While there are many experimental studies, discussed in earlier chapters, which have investigated changes in skeletal material when exposed to fire, there is little written about how to apply these findings in practice. In order to obtain data that could be efficiently analysed, a comprehensive way to collect

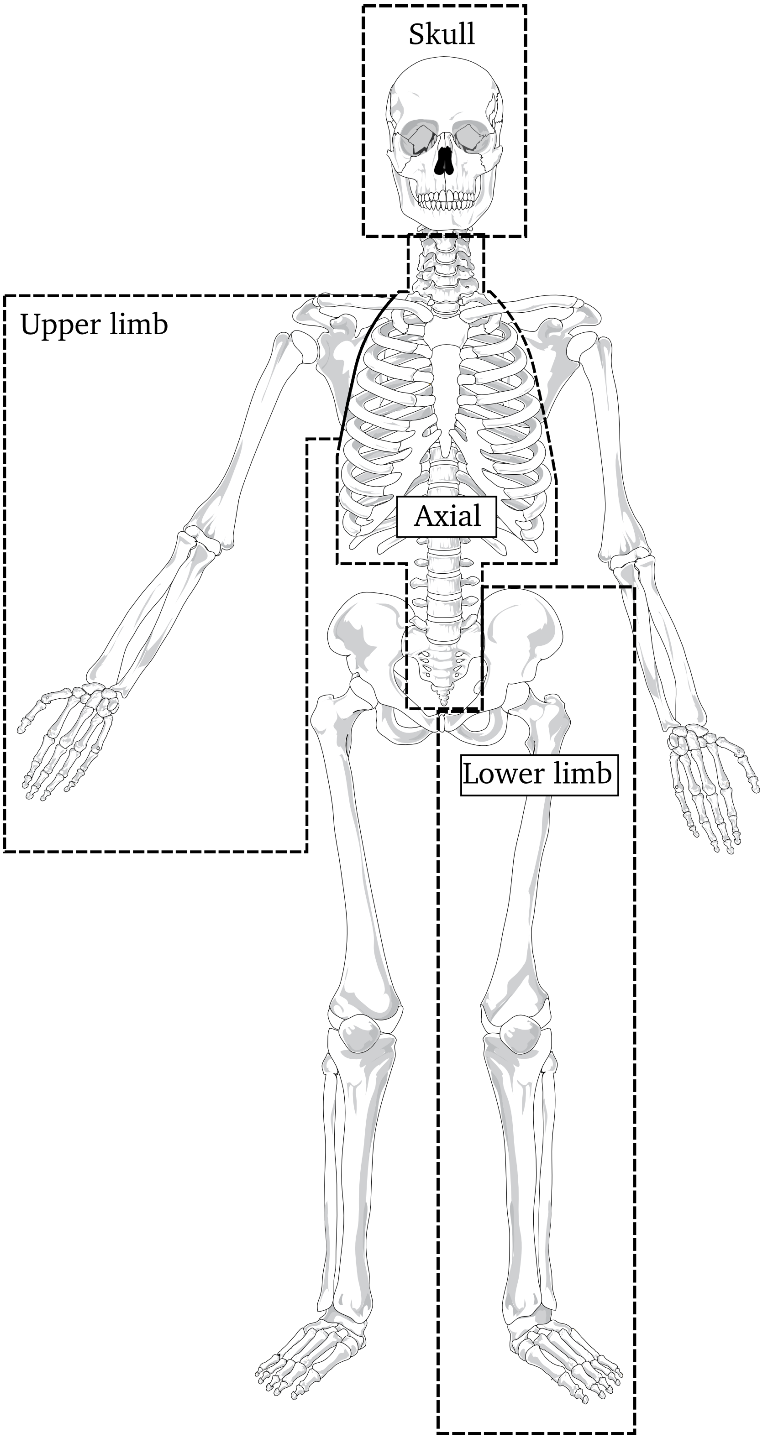

Figure 4.3: Depiction of the body elements used to categorised skeletal fragments. Skeletal drawing courtesy of Wikipedia contributor Mariana Ruiz Villarreal (user: LadyofHats), available from `http://en.wikipedia.org/wiki/File:Human_skeleton_front_en.svg`

and record it had to be developed. An important aim of this research was thus to develop an easy to use, comprehensive and effective method to record and analyse data relating to the mortuary ritual. For this reason, the standards listed above were consulted. In addition to this, recently published Scottish cremation reports were also consulted. This was an important complement to the published methodologies, since they indicated how data had actually been presented in excavation reports.

The review of these reports showed that there was much variation in how the data was reported. Although information such as weight, MNI, percentage of identified material and identified elements were included, what was included under these labels was rarely defined. Information on fragment size, colour and condition, crucial for reconstructing mortuary ritual, was often descriptive and difficult to compare between sites. Many of the shortcomings identified were overcome by using the recommendations in McKinley (2004), which was chosen to form the basis for the methods used in this thesis. However, some issues were not resolved. These included the reporting of the colour and condition of the remains, which had to be adopted from other works. To develop a way in which to record this in a useful manner was a challenging and time-consuming task. The data about each site, deposit, fragment and observation was recorded into a custom Microsoft Access database (see Figure 4.4). A printout of the data is available in the appendix on the accompanying CD. The methods adopted will be outlined below.

Each cremation burial was initially weighed in its original state (the state in which it was received) and the weight was recorded. In this state it often contained quantities of soil and stones. It was then sieved through a stack of 10, 5 and 2 mm sieves to produce three sieving fractions, as pictured in Table 4.5. The 10 and 5 mm fractions were picked free of extraneous material (such as stones and other debris). Each fraction was weighed and the weight recorded. During a trial period in the early stages of research, the 2 mm fraction was also picked free of extraneous material, but it soon became evident that very little information could be gained from this fraction, as very few fragments could be identified from it. Therefore, the extraneous material from the 2 mm fractions of these cremation deposits were weighed and compared to the weight of the bone

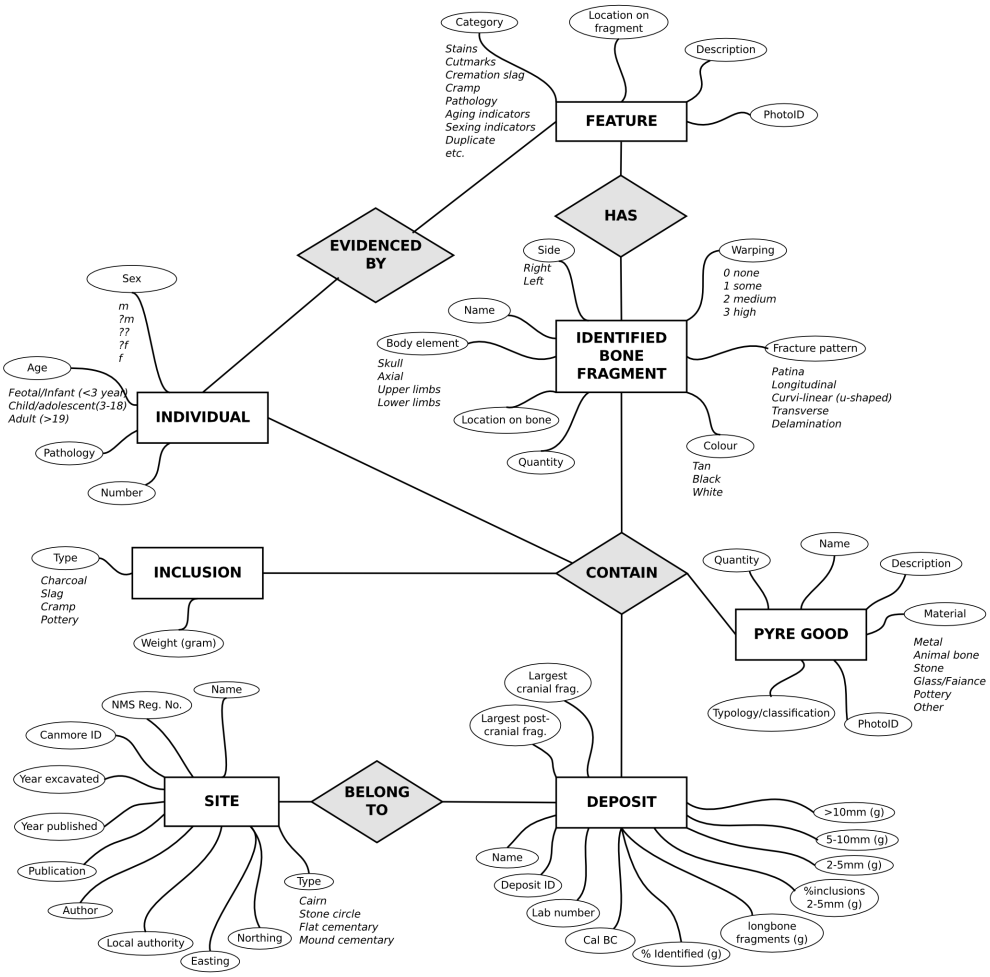

Figure 4.4: Entity-relationship diagram for the custom database used to record results.

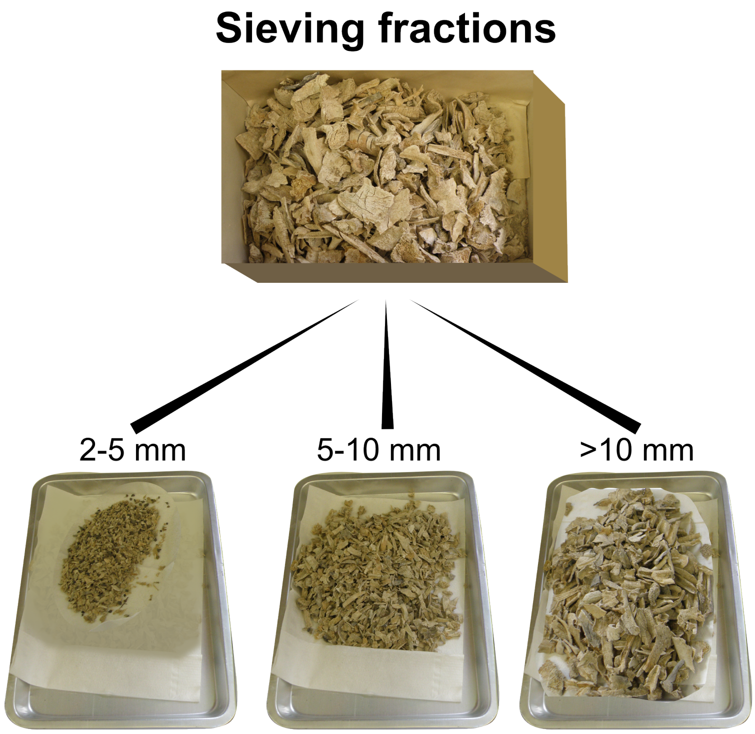

Figure 4.5: Material sieved into three fractions. A cremation deposit (Bridge of Banff EA 11) before and after sieving. Note that extraneous material has been removed, and that the bone dust (<2 mm) is not included.

in the 2 mm fractions. This was used as a comparison material to estimate the weight of extraneous material in the 2 mm fractions in the rest of the cremation deposits. For the rest of the cremation deposits, the 2 mm fraction was weighed without picking out the extraneous material. This weight was recorded. Afterwards, an estimation of the weight of the extraneous material, to the nearest 10% was made and recorded. This weight was subtracted from the total weight of the 2 mm fraction, giving an estimated weight of bone in this fraction.

The material from the 10 and 5 mm fractions was carefully processed, with each fragment being examined at least once. The material from the 2 mm sieve fraction was scanned quicker, as fewer identifiable fragments are found in this fraction (generally only tooth root fragments and fragments of skull vault). The bone fragments from each sieve were sorted into six categories: unidentified fragments, animal bone fragments, skull fragments, axial skeleton fragments, upper limb fragments and lower limb fragments. The unidentified fragments were bagged separately and not weighed. The animal bone fragments were examined to determine whether they were worked or not before being recorded, bagged and weighed.

In the next stage, the bone fragments were carefully described and recorded in the database. The identified material was then ordered into the four main parts of the body (skull, axial skeleton, upper and lower limb) and weighed and recorded. Figure 4.3 shows the classification of body elements used. Fragments were identified with the aid of standard osteological works, a comparative material of unburnt skeletal elements and casts, as well as photographs of identified cremated material. For each identified fragment a certain amount of data was recorded, including skeletal element, side, area of the bone, and colour. Where possible, other features were also recorded, such as pathological changes, age- and sex indicators, areas of poor calcination, staining, cutmarks, cremation slag, and so on. Additional data was recorded for each deposit. This included MNI, estimations of age and sex, as well as the measurements of the longest cranial and post-cranial fragments and weights. Descriptions of inclusions (pottery fragments and charcoal) as well as pyre goods were also recorded for each deposit.

4.2.1 Determining Minimum Number of Individuals (MNI)

Establishing the Minimum Number of Individuals (MNI) for cremation burials is more complicated than in the case of inhumation burials or even unburnt commingled remains, due to the warping and fragmentation of the material. The reliability of different indicators vary. Obvious differences in sexual characteristics as well as differences in colour have been suggested as useful (Gejvall, 1963), but these cannot be relied upon. Different areas of the body may vary in how male or female they appear. Additionally, when the body is fragmented and shrinking has affected different areas of the body to varying degrees, differences may be exaggerated. Uneven burning can also account for differences in colour.

Lange et al. (1987, 22) suggest that weight could be used to infer multiple cremation, with cremation burials weighing over 2500 g being very likely to contain an MNI of >1. There is a number of studies relating to the weight of cremated remains, and they show that the weights may vary significantly with the age, sex and body mass of the individual (Trotter and Peterson, 1962; Trotter and Hixon, 1974; McKinley, 1993; Holck, 2008; May, 2011; Van Deest et al., 2011). Cremation practices also affect the weight, as poorly calcined remains will weigh more than those which have been more completely calcined, since more of the organic material will remain (Holck, 2008, 49). Overviews of different studies of the weights of cremated remains suggest that the remains of an adult tends to vary between 1500 and 3500 g (Blaizot and Tranoy, 2005; Van Deest et al., 2011). When weighing only the remains measuring over 2mm, simulating archaeological cremation burial, McKinley (1993) found that her, comparatively very small sample of 15 individuals, gave a range of 1001.5 to 2422.5 g. Although a large quantity of bone may be of use to infer an MNI of >1 in cases where it is impossible to access the bones for study, such as in the case of reports of old excavations, it is generally more prudent to rely on either significant differences in age, or duplicates of identifiable fragments.

In cases where two or more individuals are present, it is difficult to decide which bone fragments belong to each individual, unless there are marked differences in age. A typical example would be the bones of a neonate and an adult, such as a Bronze Age urn found at Findhorn, Moray (Powell, 2001). Bone fragments from more than one individual need not signify that the individuals are equally well represented in the burial. In societies that made use of special cremation sites, such as Roman Britain (McKinley, 2001), it is always possible that a few bones from a previous cremation ended up with an individual cremated later. This does not constitute a multiple cremation burial in the true sense of the term, as the intermingling was accidental. In order to better understand mortuary ritual, a distinction must be made between such cases and cremation burials which intentionally contain more than one individual.

Furthermore, it is important to determine whether the burial represents a multiple burial or a collective burial. A multiple burial represents individuals buried at the same time, whereas a collective burial represents a feature where individuals could be buried at different times (Duday, 2009, 13). A typical example of a collective cremation burial is that of the British Early Bronze Age short cists (Petersen et al., 1974), which could be reopened to add the remains of new individuals. The aforementioned example of a neonate and an adult are more likely to represent a true multiple cremation burial of individuals who were probably cremated on the same pyre and buried together. In cases of modern excavations of well-preserved cinerary urns, the stratigraphy of the remains can show if the remains are mixed, or whether the remains of one individual are placed in top of the other (McKinley, 1997, 130-31).

For this thesis, only deposits containing either significant differences in development between different bone fragments or duplicates of identifiable fragments were registered as having an MNI of >1.

4.2.2 Assessment of age at death

As an individual ages, their body will change as they develop, mature and grow old (Sofaer, 2006). The assessment of age is complicated by the way in which chronological age is not consistent with biological age. Depending on both genetic and environmental factors, juveniles of the same chronological age can be in widely different stages of maturation (Tanner, 1989). Furthermore, the rate of maturation varies between the sexes, with girls being slightly ahead of boys (Molinari et al., 2004). In older individuals, differences between individuals of the same chronological age can be even more dramatic (Sofaer, 2006). Due to the difficulty in assigning an exact chronological age to individuals, age is often expressed using age ranges. Such classes are used because they make sense to us today, and they do not necessarily match the age categories used in the past (Sofaer, 2006). Age-related changes to the skeleton and dentition can be observed on a macroscopic level (e.g. Scheuer and Black, 2000), on a microscopic level (e.g. Kerley, 1965) as well as in the biochemical composition of the components of bone and teeth (e.g. Zapico and Ubelaker, 2013).

In foetal and perinatal age assessment, the number and locations of primary ossification centres are very important (Degani, 2001), although the length of various skeletal elements are also used (Fazekas and Koza, 1978). Age estimations for this category are based on few standards produced from small samples (Saunders, 2000). In older juveniles, skeletal age assessment is based on comparisons with radiographic atlases developed in the mid-20th century for specific joints or topographical regions (e.g. Greulich and Pyle, 1960; Tanner et al.,

1962) or with skeletal populations of known age and sex, such as the St Bride's and Spitalfields collections (Molleson and Cox, 1993); the St Thomas, Belville collection (Saunders et al., 1993) and the Coimbra collection (Coqueugniot and Weaver, 2007). Epiphyseal fusion continues into early adulthood, and has been studied in large collections, including on Korean War casualties (McKern and Stewart, 1957).

Both the use of skeletal populations, and radiographs of living populations are associated with limitations. The radiographic studies were conducted largely on white, middle-class populations, and may not be appropriate for other populations. Furthermore, they are not necessarily comparable with dry-bone studies (Coqueugniot and Weaver, 2007). There are not many collections with large numbers of juveniles available for use, and the ones that exist are often poorly documented and from specific communities (Usher, 2002). Dental age is more useful than skeletal age for several reasons. Teeth survive better, the growth of the dentition continues until early adulthood and dental age is less variable than skeletal age. Nevertheless, teeth are often missing and since most teeth develop before the teens, dental aging is of most use for younger juveniles (Coqueugniot and Weaver, 2007).

For younger adults, epiphyseal fusion and dentition (the third molar) are still useful for determining age at death. It is the estimation of age in adults of over 30 years, where epiphyseal fusion is complete, that presents one of the greatest problems in age assessment. It is a serious limitation since there is evidence of individuals living into very advanced age in antiquity (Roberts and Manchester, 2005). Therefore, there have been many studies of skeletal elements which are perceived to continue changing in a predictable manner throughout life (Kemkes-Grottenthaler, 2002), such as cranial sutures (Lovejoy and Meindl, 1985), the pubic symphysis (Todd, 1920) and tooth wear (Brothwell, 1981). Later on other elements, such as the auricular surface (Lovejoy et al., 1985) and sternal rib ends (Iscan et al., 1984) were added to this list. In more recent decades there has been a growing awareness of the imprecise nature and limitations of these methods, and of estimations of adult age in general (Jackes, 2000), as indicated by tests by practitioners such as Aiello and Molleson (1993).

It was not until after the advent of forensic anthropology that new techniques, including microscopic and biochemical methods, became increasingly used in archaeology (Kemkes-Grottenthaler, 2002). Microscopic methods for age estimation rely on the changes to the microscopic structure of the Haversian system of remodelled lamellar bone that occur with age, as observed in histological examinations. The pioneering study in this field was that of Kerley (1965). Later studies have found that, apart from being affected by factors such as sex and ancestry, such changes are also affected by environmental factors, including the health and nutrition of the individual (e.g. Paine and Brenton, 2006). Biochemical methods for age estimation are based on chemical changes associated with aging as observed in tissues such as collagen and dentin. These methods include aspartic acid racemisation (e.g. Yekkala et al., 2006) and changes to the structure of the dentin of the teeth (e.g. Tramini et al., 2001).

Methods for determining age of cremated individuals rely on the same principles as for unburnt ones. However, the taphonomy of the material and the relative age of the individuals present might limit the range of applicable methods. For juveniles, especially in the younger age range, dental age can often be estimated, since unerupted tooth crowns tend to survive the cremation without significant shrinkage. They are also relatively easy to identify (Gejvall, 1947). Due to the more fragile nature of epiphyses, these might not always be present. Furthermore, the heat of the pyre can make fusing or recently fused epiphyses separate, leading to an underestimation of the age of an individual (Wahl, 2008). The degree of shrinking and fragmentation make measurements of longbones virtually impossible. Other bones may be more useful. The sturdy nature of the petrous part of the temporal bone means that its morphology changes very little during the cremation process. As it is often found in cremation burials, it is useful in aging perinates and infants (Gejvall, 1947). When studying a larger material, a combination of different methods is often useful, such as that used by Smith et al. (2011) on a sample of 325 infants from the Tophet (cremation cemetery) of Carthage. The researchers used a combination of measurements of tooth crowns, petrous part of the temporal, as well as microscopic analysis of tooth crowns. Metric methods for estimating age for juveniles have also been developed, including that by Wahl (1983), which uses measurements of the thickness of the skull.

For adults, determination of age at death can be much more problematic. The firing process destroys some elements indicative of age, such as erupted tooth crowns. It also fragments other relatively reliable elements such as rib ends, pubic symphysis and auricular surface to the extent that they often cannot be identified (Fairgrieve, 2008, 108). In a review of methods for determining age at death in cremated remains, Correia (1997) found that while many early practitioners found ecto- and endocranial sutures relatively useful most studies from the late 1960s and onwards indicate that sutural closure is an unreliable indicator of age. Nevertheless, the use of sutural closure has survived in Scandinavia, where it has been used in influential works (Sigvallius, 1994; Holck, 2008). Histological studies, involving studying the osteons, could be informative (Holck, 2008; Wahl, 2008). However, this method has not been extensively tested on cremated remains.

For this thesis three broad age ranges were used: foetal/infant (pre-birth - c. 3 years), child/adolescent (c.3 years - c. 18 years or the cessation of growth) and adult (cessation of growth and onwards). Both the broad and, where applicable, the more precise age ranges were recorded in the database. Only the three broad age ranges were used in analyses of the data and subsequently discussed in the results.

Age for non-adults and young adults was determined chiefly based on appearance and fusion of skeletal elements as well as the eruption of teeth. Age in mature adults was determined using multiple age indicators, chiefly changes in the pubic symphysis and auricular surface, as well as general indications of old age, such as attrition of the vertebrae and joints.

4.2.3 Assessment of sex

Like all organisms with sexual reproduction, humans are sexually dimorphic. Although it is less marked than in the soft tissues, the sexual dimorphism in the skeleton can be sufficient to differentiate the skeleton of an adult female from that of an adult male (Stini, 1985). In the skeleton, sexual dimorphism is most marked in the pelvis. It is the role of the female pelvis in childbirth that severely limits its morphological variation compared to that of the male pelvis (Meindl et al., 1985). The second most sexually dimorphic skeletal element is the skull, although here variation is not as restricted. In the rest of the skeleton sexual dimorphism is less defined. In general, female skeletal elements tend to be smaller and more gracile than male ones, due to the greater muscle mass and higher stature of males (Stini, 1985). The sexual dimorphism and sexual differentiation seen in humans is related to sex hormones. Masculinisation seems to be the predominant role of sexual differentiation, as foetuses which are not masculinised develop along female lines. Masculinisation depends on the testes, which produce testosterone, the male sex hormone (Stini, 1985). Levels of testosterone are high during foetal life. The levels drop after birth, and do not rise again until puberty, when rise causes significant changes, including growth of muscles and (together with growth hormone) the adolescent growth spurt. In females, oestradiol, one of the female sex hormones, causes the pelvis to grow during puberty (Tanner, 1989). Changes to the female pelvis occur within a short span of time, meaning that reliable evaluations of sex can probably be made from around mid-puberty (Greulich and Thoms, 1944). Sexual dimorphism is not as evident before puberty, which makes it difficult to estimate the sex of juveniles (Hunt and Gleiser, 1955).

Sex assessments of human skeletal remains can be divided into two groups: morphological observations and metric techniques. Morphological observations are restricted to the two most sexually dimorphic elements, the pelvis and the skull (Rogers and Saunders, 1994, 1047). For experienced osteologists the accuracy obtained by morphological observations of the complete skeleton is over 90% (Buikstra and Mielke, 1985). Sex assessments of elements other than the skull or pelvis tend to be based on metric techniques. This allows sex to be determined using a broader range of skeletal elements (Buikstra and Mielke, 1985). Metric techniques are argued to be easier to test statistically and are easier to teach (Rogers and Saunders, 1994).

The difference between the male and the female pelvis is often dramatic enough that a correct estimation of sex on a complete pelvis can be achieved by ocular inspection alone. However, as the pelvis is a part which often tends to be damaged in the soil, other methods are needed. The ischium-pubic index is the most well-known of the metric methods for determining sex using the pelvis. It quantifies the relative proportion of the pubic part of the os coxae (Washburn, 1948). It has a high level of accuracy (Buikstra and Mielke, 1985), but requires the pelvis to be relatively intact and is very time consuming when working with large assemblages (Phenice, 1969). Furthermore, the point in the acetabulum from which the measures are taken is difficult to define (Patriquin et al., 2005).

Morphological methods for sexing the pelvis include what is often described as the most accurate method for determining sex, the Phenice method (Phenice, 1969). The method is meant to be unambiguous, with only three criteria, which are either present or not. These are the ventral arc, the subpubic concavity and the medial aspect of the ischio-pubic ramus. One of the most important aspects of these criteria is that they emphasise 'femaleness'. This should counter the bias inherent from the fact that most skeletal markers in sex determination emphasise maleness (Buikstra and Mielke, 1985). The accuracy of the Phenice method is attested by several studies on North American osteological collections. However, it is less accurate when used on European materials. The differential results may be related to the Phenice method not being as objective as thought, that the level of observer experience is important or that there is in fact a different level of sexual dimorphism in the studied samples. The reason is difficult to determine, since the basis of the sexual dimorphism in the Phenice characters is not understood (MacLaughlin and Bruce, 1990). A number of traits on the pelvis have been used for sex determination, meaning that even fragments of the pelvis can be used. These traits include the acetabulum (Nagesh et al., 2007; Papaloukas et al., 2008), the greater sciatic notch (Steyn et al., 2004; Walker, 2005; Takahashi, 2006), the subpubic angle (Igbigbi and Nanono-Igbigbi, 2003), the pubis (Nagesh et al., 2007; Rissech and Malgosa, 2007), the ischium (Rissech and Malgosa, 2003), the ilium (Rissech and Malgosa, 2005), the pelvic inlet (Correia et al., 2005), the sacrum (Tague, 2007) and the auricular surface (Ali and MacLaughlin, 1991).

Sex estimations based on the skull rely on the fact that the male skull tends to be more robust than the female. In contrast to the pelvis, the skull varies with ancestry, and this can confound results. The most widely used metric method was devised by Giles and Elliot (1963), and uses discriminant functions based on 11 measurements. Although the original publication claimed an accuracy of 85%, this is not supported by later tests. For example, only 65% accuracy was claimed based on a Finnish sample (Kajanoja, 1966). Sex determination using morphological characteristics of the skull can give high levels of accuracy, over 90% (Buikstra and Mielke, 1985). The most widely used morphological method is the one described in Ubelaker and Buikstra (1994), which uses the nuchal crest, the mental eminence, the mastoid process, the supra-orbital margin and the glabella. The characteristics are visually assessed and scored from 1 to 5, with 1 being typically female and 5 typically male. Walker (2008) used these five traits for a discriminant function analysis. His results indicated that the accuracy of discriminant functions using scores from visually assessed traits were comparable to those using craniometric observation. Other traits which have also been used for determining sex include the foramen magnum and occipital condyles (Kjellström, 2004; Wilkinson, 2004), the angle of the frontal bone (Wilkinson, 2004), the palate (Wilkinson, 2004), the temporal bone (Wahl and Graw, 2001; Lynnerup et al., 2006) and the frontal and parietal bossing (Wilkinson, 2004).

Sex assessments based on elements other than the skull or pelvis tend to be seen as the 'second choice' when sexing complete skeletons (MacLaughlin and Bruce, 1985, 414), but are crucial for fragmentary remains. It is within this area that metric techniques are most helpful, as they dramatically broaden the range of elements that can be used for sexing (Buikstra and Mielke, 1985). Since the middle of the last century, metric techniques have been used to sex postcranial bones. This has resulted in methods based on a great quantity of bones including long bones (Rogers, 1999; Igbigbi and Msamati, 2000; Mall et al., 2001; Sakaue, 2004), the pectoral girdle (Dabbs and Moore-Jansen, 2010), vertebrae (Wescott, 2000), rib ends (Torwalt and Hoppa, 2005) as well as hand- and foot bones (Sulzman et al., 2008; Dayal and Bidmos, 2005). In order to be of practical use, such methods should be expected to show an accuracy of at least 80% (MacLaughlin and Bruce, 1985). When using such techniques, it is difficult to know how representative the sample used to develop the technique is for individuals outside that population (Iscan and Miller-Shaivitz, 1984). Metric techniques can also be applied to fragmented limb bones, such as the femur (MacLaughlin and Bruce, 1985). When sexing fragmented limb bones it is very important that the measures used are carefully described so that they can be correctly applied. It is therefore an advantage to base measurements on suitable topographic landmarks of bones, or use measures such as maximum diameter (MacLaughlin and Bruce, 1985).

Sexual dimorphism is present before puberty. Males tend to be larger than females, have higher bone density and greater bone thickness (Saunders, 2000), but mature at a slower rate than females (Tanner, 1989, 56). Still, the determination of sex on subadults is problematic, as it is difficult to use these observations for sexing. Methods such as comparing dental and skeletal maturation have been tested (Hunt and Gleiser, 1955). Permanent teeth show sexual dimorphism and can be used to sex subadults. However, this is problematic as the magnitude of sexual dimorphism is small and varies between populations (Saunders, 2000). Many of the studies of sexual dimorphism in juveniles have focused on the morphological differences of the pelvis (Boucher, 1957; Schutkowski, 1993; Weaver, 1980; Wilson et al., 2008), but the results have been unreliable. Some initial success has also been achieved in the study of the skull, including the mandible (Loth and Hennenberg, 2001). However, more research is needed, as testing gave significantly lower accuracy (Scheuer, 2002; Franklin et al., 2008).

Sex determination of cremated individuals is similar to that of unburnt remains. Much the same methods have been used, both metric and morphological. Correia (1997) suggested that some earlier practitioners used traditional methods to determine sex rather uncritically, apparently unaware of the effect of shrinkage and the inaccuracies caused by it. Fewer individuals can generally be sexed than aged (Holck, 2008, 50-51). Even if appropriate indicators are present, they might be so fragmented as to be of little use.

Morphological methods of sexing cremated remains have traditionally focused on the pelvis and the skull. As detailed above, the pelvis is the more reliable of the two, but tends to fracture significantly during the cremation process and subsequent burial (Correia, 1997; Sigvallius, 1994; McKinley, 1994c; Holck, 2008; Fairgrieve, 2008). Fairgrieve (2008) stated that in his experience, the Phenice method (Phenice, 1969) could be used relatively often, as the ventral arc and the medial aspect of the ischio-pubic ramus are often found in cremated remains, if not the pubis. However, Holck (2008, 53) reported that the only sex indicator in the pelvis regularly encountered was the sciatic notch.

McKinley (1994c, 19) encountered the sciatic notch relatively often in the Spong Hill material, but in her experience the fragments were often not large enough to be of use. Correia (1997, 283) suggested that apart from the sciatic notch, the shape of the ilium could be used for sexing. She emphasised the importance of the researcher's experience, as the shrinkage could otherwise cause males to be mistakenly identified as females. Because of the fragility of the pelvis, the determination of sex on cremated individuals tend to rely heavily on the skull (Fairgrieve, 2008). Although the skull fragments during the cremation process, many of its parts are relatively robust and can be easily identified (Correia, 1997). Gejvall (1947, 42-43) emphasised the usefulness of the glabella and the supraorbital margins for determining sex. Later, other elements have been added to the list, including the alveoli, the mastoid process, the external occipital protuberance and the frontal process of the zygomatic (Holck, 2008, 53).

Due to the problems associated with determining sex on cremated remains, several metric methods have been devised. The earliest one was developed by Gejvall, in order to more accurately determine the sex of the individuals from the Swedish Iron Age cemetery of Horn (Gejvall, 1948). The method was developed based on 99 modern individuals (50 males and 49 females), aged 17-97 years, from two Swedish crematoria. Based on this material, Gejvall devised seven measurements to be taken from the cranium, the humerus, the radius and the femur. Another method was devised by van Vark (1975), also from modern cremated remains, using 79 measurements. Wahl (1982) presented a method based on measurements of the petrous part of the temporal bone, including internal measurements taken with lengths of cotton passed through the canals of the bone. This part, which can often be identified in cremated remains due to its sturdy nature, has attracted some interest, especially in Germany, and some studies have indicated that it might be of use in determining sex on cremated remains (e.g. Wahl, 1981; Schutkowski and Herrmann, 1983; Wahl and Graw, 2001).

In a discussion of metric methods, Holck (2008) questioned the reliance of skull vault measurements, used by both Gejvall and van Vark, arguing that it was not a reliable indicator of sex. He found that very few bones from the material he studied were suitable for metric methods. McKinley (1994c) tested the methods of Gejvall and van Vark in her work on over 2000 cremation burials from the Anglo-Saxon cemetery of Spong Hill, Norfolk. She suggested that the measurements in van Vark's method were difficult to use. Only 7.6% of the measurements could be taken frequently, as the bones needed for measurements were often missing or too fragmented. She found that the method suggested by Gejvall (1948) for measuring skull vault thickness was of limited reliability, as few of her readings fell into the clearly male or clearly female range. Furthermore, the description of where to measure the long bone shafts were not detailed enough (McKinley, 1994c). She suggested that there was a danger in viewing metric data as exact, universal measures. It would seem as if, at the present time, morphological sexing using features of the skull and the pelvis are more reliable.

For this thesis, sexually dimorphic features of the skull and pelvis were scored from 1 to 5, where 1 indicated typical female (delicate) and 5 typical male (robust) morphology, following current standards (Ubelaker and Buikstra, 1994; Brickley, 2005). The sexually dimorphic features of the skull used were the nuchal crest, the mastoid process, the supra-orbital margin, the supra-orbital ridge or glabella and the mental eminence. The sexually dimorphic features of the pelvis used were the greater sciatic notch and the pubic region.

Additional indicators used were marked robusticity, including the general shape of the mandible and the presence of marked muscle attachments. These were not scored as those mentioned above. Instead, the presence of marked muscle attachments or marked robusticity were used as indicators of male sex. Sex was expressed as one of five categories: female, ?female, unknown, ?male and male.

4.2.4 Stature

The stature of an individual depends on the length of skeletal elements, including the long bones of the legs, the spinal column and the cranium, but also on soft tissue, including intervertebral discs (Tanner, 1989). Stature changes through life, it increases as the individual matures and decreases with old age. Stature estimation is hampered by a lack of reliable data. Self-reported stature in living

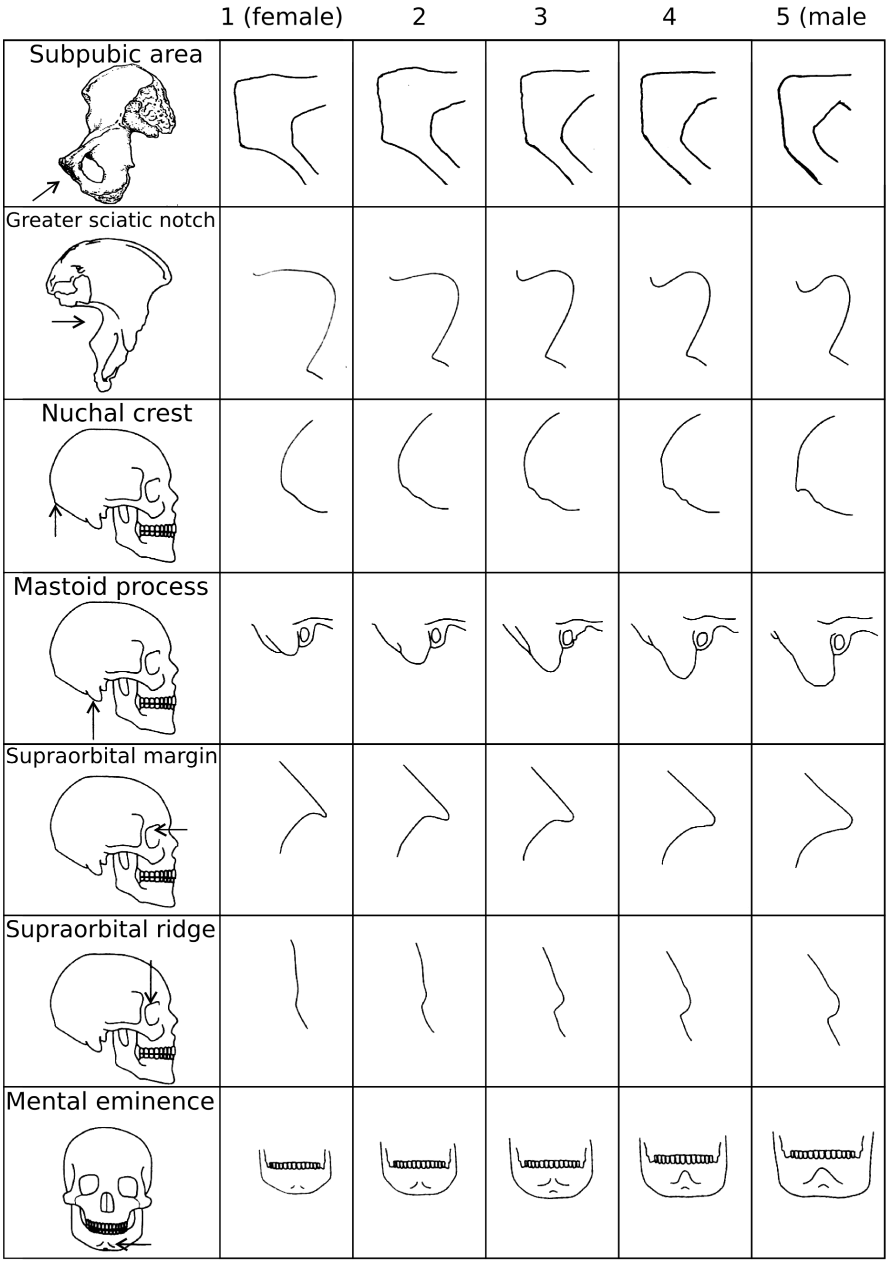

Figure 4.6: Sex indicators of the pelvis and skull, adapted from Brickley (2005) and Sofaer (2006).

individuals is often exaggerated (Giles and Hutchison, 1991). Furthermore, in archaeological samples there is simply no record of statures (Formicola, 1993).

The methods for reconstructing stature can be divided into those using the complete skeleton, by adding together the bones forming the stature (anatomical methods), and those using formulae based on the length of specific bones (mathematical methods) (Raxter et al., 2006). Anatomical methods are more reliable, as the only sources of error are soft tissue thickness and curvature of the spine. The main drawback of anatomical methods is that they require complete skeletons (Formicola, 1993, 351). The most used technique for anatomical stature assessment was developed by Fully (1956). It is still considered useful, even if some of the measurements are not defined correctly (Raxter et al., 2006).

Mathematical methods are based on bodily proportions. They predict stature based on measurements of bones. However, bodily proportions vary between individuals of different sex and ancestry (Tanner, 1989). Hence, using an inappropriate formula can cause significant errors (Formicola, 1993). Formulae used to estimate stature can be adjusted to compensate for advanced age (Raxter et al., 2006). The best known mathematical method is that devised by Trotter and Gleser (1952) for American males. The method compared measurements of dry long bones of military personnel killed in World War II with the known stature of the same individuals taken in life (Trotter and Gleser, 1952). The study was later refined using military personnel killed in the Korean War (Trotter and Gleser, 1958).

Since then, numerous regression formulae have been devised for different populations (Genovés, 1967; De Mendonca, 2000; Muñoz et al., 2001; Ross and Konigsberg, 2002; Hauser et al., 2005; Celbis and Agrimitis, 2006). These are all based on long bones, which are the most accurate for stature determination. However, due to the fragmentation of archaeological and forensic materials, mathematical methods have been developed for other bones as well, including the metacarpals (Meadows and Jantz, 1992), the calcaneus (Bidmos, 2006) and the metatarsals (Bidmos, 2008). There are also measurements for fragments of long bones, mainly the ends, which tend to have characteristic landmarks which make measurements easier to define (De Mendonca, 2000; Wright and Vasquez, 2003; Chibba and Bidmos, 2007). The stature determination of juveniles is problematic, as bodily proportions change during growth (Tanner, 1989), but a few studies have produced regression formulae (Ruff, 2007; Smith, 2007).

The cremation process will cause a more dramatic shrinkage, warpage and fragmentation of human remains than simple inhumation. The rate of shrinkage varies between different elements and types of bone, and studies of shrinkage have reached different conclusions (e.g. Gejvall, 1947; Dokladal, 1970; Iregren and Jonsson, 1973; Rösing, 1977; Herrmann, 1977; Grupe and Herrmann, 1983; Shipman et al., 1984; Thompson, 2005). This means that if stature estimations are attempted at all, they will produce results with a larger error margin than results from unburnt remains (Fairgrieve, 2008). A number of studies have attempted to use regression formulae to estimate stature in cremated remains (Lisowski, 1968; Malinowski and Porawski, 1969; Piontek, 1975; Rösing, 1977). In a review of cremation research, Correia (1997) found that there was as yet no satisfactory method of stature estimation on cremated remains. Holck (2008) indicated that measurements of the width of joints might potentially be used to calculate the stature of cremated individuals, as these would be more likely to be found in a complete state than long bone shafts. However, he desisted from using the method, as the error margin was too large. Current research on the topic is lacking, and although some practitioners based in Central Europe estimate stature on cremated remains (e.g. Wahl, 2008), there seems to be a geographical bias, since this is almost never attempted on archaeological cremated remains in Scandinavia, the British Isles or North America.

No stature estimations were attempted for the remains used in this thesis.

4.2.5 Cremation technology

Fracture patterns and warping

A number of studies have attempted to identify differences between remains cremated as fleshed bodies, and those cremated as dry bones. The focus has mainly been on differential patterns of warping and fracturing. Studies of whether cremated bones were dry or fleshed at the time of cremation have tended to be produced within osteoarchaeological rather than forensic research, in contrast to much other research on heat-related changes in bone. The first attempts to differentiate between these modes of cremation in the archaeological record were related to understanding the cremation practices of the prehistoric cultures of the United States. Webb and Snow (1945) had cremated remains analysed by the anthropologist Wilton Krogman in order to determine whether the remains had been cremated as dry bone, or while still fleshed. Krogman suggested that dry bone cremation was indicated by cracking or checking similar to the cracks in the patina seen in old oil paintings, whereas fleshed cremation was indicated by incomplete calcination (Webb and Snow, 1945). This was later challenged by Baby (1954), in his study of Hopewell cremation practices. Based on the burning of dissecting room cadavers, he suggested that dry bone cremations were indicated by superficial cracking or checking, fine longitudinal fractures, deep longitudinal fractures and a lack of warping. Fleshed bodies were indicated by deep transverse splitting or checking, as well as extensive warping. Both types of bone could thus show checking, and it was the nature of this 'checking' which determined if the bone had been cremated dry or fleshed.

A decade later, Binford (1963) attempted to replicate Baby's results. In his experiment, he burned dry archaeological human bones, recently macerated human bones and parts of a green monkey on charcoal fires. On the whole, Binford's results supported Baby's findings. He concluded that dry bone showed mostly longitudinal fractures, an absence of warping, and superficial angular cracking; whereas cremations of green bone or fleshed bone showed deep transverse fractures, which were frequently curved. Fleshed bone also showed much warping. The distinction between fleshed and green bone (newly defleshed) cremation was further explored by Thurman and Willmore (1981), who suggested that a distinction could be identified. Their findings for fleshed cremated bones varied slightly from Binford's results. They described serrated, transverse fractures and diagonal cracking in fleshed cremated bones, whereas green bones only had serrated fractures at the epiphyses, parallel-sided fractures in the shaft and less marked warping.

The findings of Buikstra and Swegle (1989) stood out from earlier studies. They found that dry bone could also show warping. They suggested that the features described as indicating dry bone cremation, including superficial cracking, fine longitudinal cracks, deep longitudinal fractures and a lack of warping, could also be found on green and fleshed cremated bone. Furthermore, they found that curved fractures occurred in both green and unfleshed bones, and that these fractures were rare. They also found that colour was a better way of identifying dry bone cremation, as it did not change colour as dramatically as fleshed or green bone. Fleshed bone was indicated by the presence of clinker, a material resulting from poorly combusted soft tissues. Their findings were later supported by observations of dissection room cadavers and fleshed bodies. McKinley (1994c) found little difference between dissected cadavers and fleshed bodies in terms of fracture patterns. Instead, there were differences in calcination patterns, as dissected cadavers burnt more uniformly. Buikstra and Swegle (1989) indicated that the differences in results could be due to different methodologies and stressed a need for careful descriptions of methods, something that was lacking in earlier publications.

These variations in methodology, and the lack of standardisation is arguably the greatest problem in trying to determine the state of cremated remains prior to cremation. In a review of the subject of dry and fleshed cremation, it was argued that there was no satisfactory method of differentiating between the two (Correia, 1997). Later experimental burning of sheep bone by Thompson (2005) found no evidence to support the assumption that warping was more apparent in bone burned whilst fleshed compared to dry bone. In a more recent review of fractures in cremated remains, Fairgrieve (2008, 52) devoted little energy to the subject and suggested that it was more important to be able to determine whether fractures were heat-induced or due to other reasons, such as direct trauma. More research is required for determining the difference between fleshed and dry bone cremation.

Efficiency of cremation

Reconstructing the efficiency of the cremation process, or how well the bone has been burned, is central to the discussion of cremation technology and ritual. One of the most reliable methods for assessing the temperature and efficiency of cremation is x-ray powder diffraction, which is used to study the crystalline structure of cremated bone. Samples of cremated bone are ground into a powder and the x-ray diffraction patterns are recorded using a diffractometer. The first major study of this kind was by Shipman et al. (1984). The method was used to determine whether fragments of bone had been burned or not, and the maximum temperature that the fragment had reached. More recently, x-ray diffraction has been used not only to determine maximum temperature (Enzo et al., 2007), but also to determine the duration of the burning (Piga et al., 2008). It has also been used to differentiate boiled bones from un-boiled bones, as the changes are more subtle than in burnt bone, as well as the duration of boiling (Bosch et al., 2011). The changes in the crystalline structure of cremated bone have also been studied using electron microscope (e.g. Holden et al., 1995a,b; Quatrehomme et al., 1998).

The most common macroscopic method to assess the efficiency of cremation is to study colour changes. These changes are related to the structural and chemical changes of the bone as it is exposed to increasing temperatures (e.g. Shipman et al., 1984; Correia, 1997), causing the oxidisation of the organic components and changing the mineral component of the bone (Fairgrieve, 2008). There are several studies of colour changes in cremated remains (e.g. Shipman et al., 1984; Nicholson, 1993; Holden et al., 1995b; Hiller et al., 2003; Devlin and Herrmann, 2008; Walker et al., 2008). The exact sequence of the colour changes, and at what temperature they occur, are not agreed on (Fairgrieve, 2008). This is mainly because some of these studies have attempted very detailed schemes, in which a very wide spectrum of colours is used to outline comparatively small fluctuations in temperature (e.g. Shipman et al., 1984). Using a very broad scale of colour changes, Holden et al. (1995b) found that bone is black at 300°C, at 600°Call organic components (collagen fibres, proteins and fat) in the bone is combusted and the bone turns grey. At 800°C, the bone is white and does not change further. A bright white colour and porcelain-like texture is universally accepted to represent the final stage of these changes (Correia, 1997; Devlin and Herrmann, 2008).

It is important to note that surface bone colour is an imprecise way of assessing the maximum temperature that bones have been exposed to. Colour is also affected by other factors. Soil conditions can cause the bones to be stained darker, through diagenesis (Devlin and Herrmann, 2008). Burning environments rich in carbon makes bone fragments retain a dark colour, even if burnt at high temperatures, as they absorb carbon from the surroundings

(Walker et al., 2008). If bone is heated without oxygen, the inversion stage of the cremation process is halted, preventing the loss of carbonates from the bones. In extreme cases, in which bone has been burned purposefully in reducing environments, the result is bone charcoal (Gansum, 2004), which is dark in colour despite having been exposed to a high temperature. Furthermore, recording the colour of an object presents a number of challenges. Because colour is light reflected by a surface, the lighting conditions at the time of observation are crucial. In addition, individual differences, such as eyesight, can introduce interobserver error (Devlin and Herrmann, 2008, 112). Verbally describing a colour is notoriously difficult and systematised designations such as the Munsell soil colour chart may decrease ambiguity (Devlin and Herrmann, 2008), but are time-consuming.

Analysing the colour of cremated remains is complex. A number of different colours are usually present on the cremated remains from one body, or even on a single bone fragment (Fairgrieve, 2008). Correia (1997) argued that estimating the pyre temperature is difficult, since it would have to take into account all of the colours exhibited. However, patterns of calcination are frequently used to reconstruct the position of the body on the pyre (e.g. Wells, 1960; McKinley, 1994c; McSweeney, 1995, 1997b; Roberts, 1998b,a; Powell, 2001). These are generally based on the presence of poorly calcined (dark-coloured) bone, rather than on every observed nuance.

Calcination patterns

Calcination is dependent on both intrinsic and extrinsic factors (McKinley, 2008). Intrinsic factors include depth of soft tissues, as these serve to insulate the bones from the heat (McKinley, 2008), and the thickness of the bone itself, as thicker and denser bones may be calcined on the outside but black further away from the surface (Symes et al., 2008). Extrinsic factors include the weather, as rain or wind can extinguish the pyre completely, or at least cause the more outlying body parts to be less well burned (McKinley, 2008). The construction of the pyre, including its size and contact points, would also affect burning (Wells, 1960).

Most commonly, calcination patterns are interpreted as being the result of extrinsic factors, especially the position of the body on the pyre, and to an extent the construction of the pyre. This can be traced back to a pioneering study of Anglo-Saxon cremation by Wells (1960), in which he attempted to scientifically determine the position of the body on the pyre in Anglo-Saxon cremation, using comparisons from a modern crematorium. Wells (1960, 34-35) noted that some of the poor calcination seen could not be explained by intrinsic factors, especially depth of soft tissue. This included poorly calcined fragments of scapula, occipital and spinous processes of vertebrae. Based on this, he concluded that the body must have been lying on the ground, with the pyre material heaped over it. His conclusions were discredited by later research (McKinley, 1994c).

The size and construction of pyres is sometimes said to be the reason for areas of poor calcination (McKinley, 1994c, 83). On small pyres, the feet and lower legs would protrude. Furthermore, as the arms moved outwards as the fire got going, they would also end up outside the immediate heat. If such a pyre was not well tended, this position would make the extremities poorly calcined (McKinley, 1994c). Cases in which either the left or the right side of the body is more completely calcined than the other has been suggested to be because the pyre collapsed to one side, causing one side of the skeleton to be buried in the debris. If there was no raking of the pyre, this situation would have caused the buried half to be less well calcined (McKinley, 2008). Another explanation for the same effect is that the body might have been placed on its side. This explanation has been put forward for a Scottish Bronze Age cremation found at Findhorn, Moray (Shepherd and Shepherd, 2001).

In comparison, the importance of intrinsic factors is not as well studied. Symes et al. (2008) suggested that what they termed 'burn patterns' is an invaluable tool in forensic cases. This includes tissue shielding in bone, colour changes and the differentiation of fracture patterns caused by fire from those caused by trauma. By using 'normal' burn patterns (how a complete, fresh body burns) as a benchmark, it is possible to detect cases of perimortem trauma. A similar approach could be used to determine if a body was fleshed or unfleshed at the time of cremation. In a body burnt unfleshed, one would expect not to see the effect of shielding soft tissues. Some limited observation by McKinley

(1994c) supports this. She found that dissected bodies showed very little colour variation compared to fresh bodies. Nevertheless, although Symes et al. (2008) outlined the cremation process, and included a figure of a skeleton in which colours indicated the order in which various parts of the skeleton were affected by the fire, there were no references cited to suggest which sources had been used to create the model.

Staining

The colours observed on cremated remains are not just the outcome of changes to the bone structure caused by the cremation process. As with unburnt remains, cremated remains may be stained by materials such as iron, copper or zinc, which might have occurred either on the pyre, or in the grave (Gejvall, 1963, 282). Nevertheless, the interpretation of stains on cremated bones, including the materials and processes causing these stains, is poorly understood due to a lack of research (Correia, 1997). The most common colour of stains seen in Scottish Bronze Age cremation burials are nuances of blue and green (Medina-Pettersson, 2008, 49). An early account of stains on cremated remains from Courthill, South Ayrshire, a well-preserved Neolithic mound, suggested that the bones were white when first encountered, but turned blue after being exposed to the air (Patrick, 1874). The most common interpretation of these stains is that they are the result of copper or copper alloy objects placed with the body on the pyre, or in the urn (McKinley, 1994a). Another interpretation is that green or blue staining is caused by iron phosphates present in the soil (Davidson, 1952).

Chemical analysis of green/blue stains on cremated bone have rarely been undertaken. In fact, only one such case could be found by this author. These were the remains of a young woman and a newborn child from Findhorn, Moray, which were extensively stained with blue/turquoise stains. The stains on one fragment from this burial were analysed using qualitative energy dispersive X-ray fluorescence. The results indicated that the stains were associated with higher levels of copper than the surrounding bone, even though the levels were still relatively low. It was suggested that the most probable source of copper was a corroded copper alloy object in the vicinity of the bones (Shepherd and Shepherd, 2001).

Methods used

Finding ways of collecting and representing the data related to cremation technology was one of the biggest challenges associated with the research.

Attempts were made to use a Munsell chart to describe the colour of individual fragments, as done in other studies (e.g. Shipman et al., 1984). However, it was concluded that this was not an efficient method. The colours of the Munsell chart were not easy to use for describing bone colour. Furthermore, one fragment could show many nuances of colour, and fragments were also affected by soil staining.

Instead, the main colour of a bone fragment was recorded using three very broad categories: tan, black and white (see Figure 4.7), following the guidelines suggested by Ubelaker and Buikstra (1994). This was to give a rough indication of the temperatures attained by the bones. Tan included pale brown shades and indicated bone which has been slightly heated, up to c. 200°C. Black included black and dark grey shades, and indicated bone which was charred, but not fully calcined (between c. 200 - 600°C). White included very light grey, cream and white as well as bluish shades and indicated material in which most or all of the organic components have been lost (over c. 600°C). The benefits of this using these very broad categories instead of a Munsell chart is that there is less possibility of error and it removes the problems of soil staining. There are generally very few tan fragments in well calcined cremation deposits. In fact, there were none in the studied material.

Apart from the main colour, the staining of the bones (excluding soil stains) and areas of poor calcination were recorded (see Figure 4.7). For both of these phenomena, the colour, extent and position of the staining/poor calcination were recorded. Areas of bones which were darker than the generally white colour of cremated bone (excluding stains) were recorded as poor calcination. Areas of poor calcination were classified as dark, mid- or light grey. In the case of areas of poor calcination, so-called 'sandwich effect', was recorded. Sandwich effect is an effect in which outer layers of bone (which are are affected by the heat at an earlier point than the inner layers) are completely calcined, but inner layers are not, resulting in a darker colour. The decision tree used to classify colour and related features is shown in Figure 4.7.

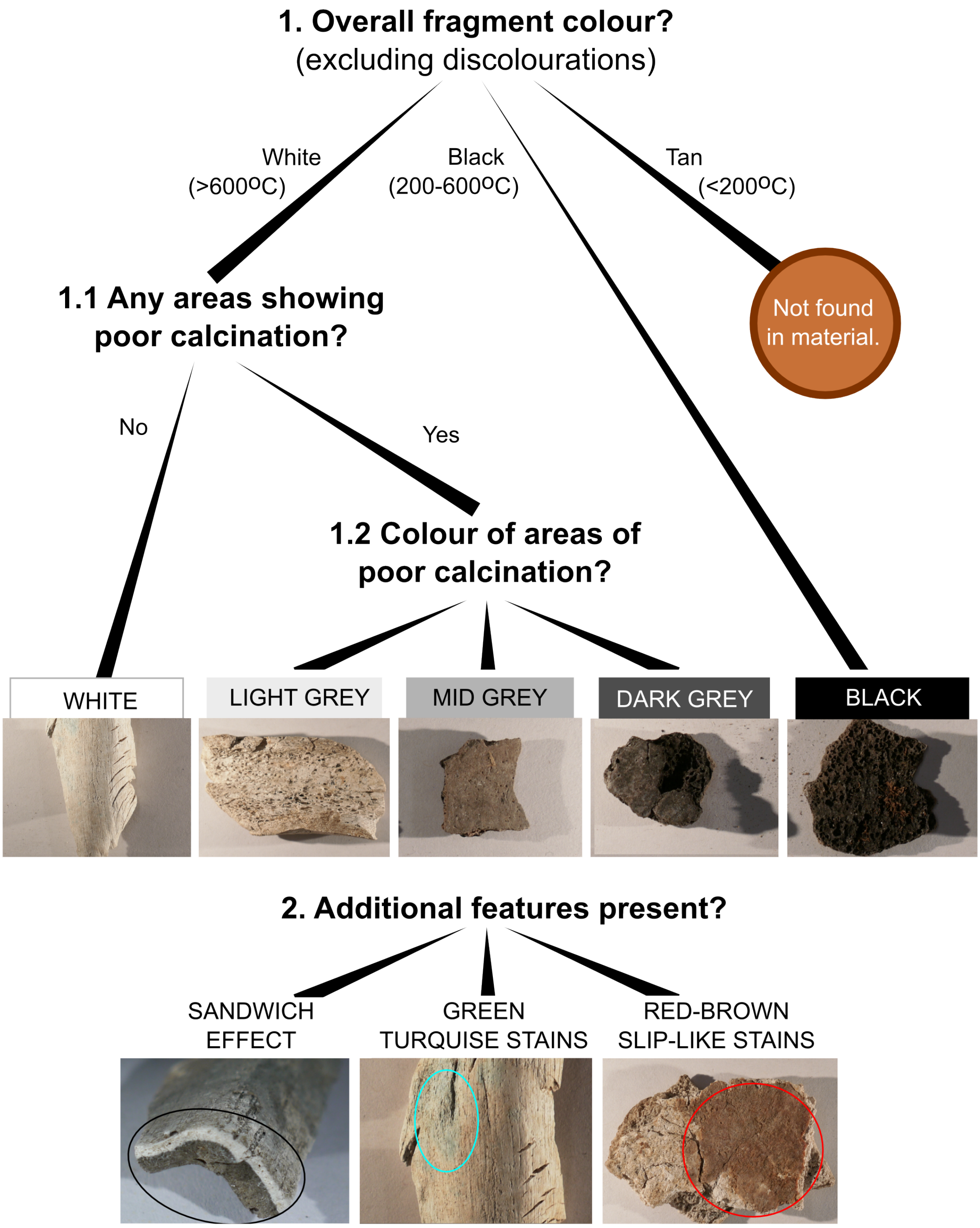

Figure 4.7: Decision tree used to classify the overall colour and additional features on fragments.

For each cremation burial, the longest cranial fragment as well as the longest post-cranial fragment was measured and recorded. This, together with the percentage of identified material, was used as a measure of fragmentation level for each burial.

The shape of fracture patterns and the degree of warping are often discussed in the literature, as seen above. They have been used to discuss whether a person was cremated whilst still fresh and fleshed or whether dry bones were cremated (Webb and Snow, 1945; Baby, 1954; Binford, 1963; Thurman and Willmore, 1981; Buikstra and Swegle, 1989). During an early stage of this research, methods for recording warping and fracture patterns were developed and used on a sample of cremation burials from Scotland (including some of the cremation burials used for this thesis), England and Sweden.

Warping was scored for limb bones (the bones in the arms, hands, legs and feet) and skull bones, as warping is more marked in these than in more spongy bones such as the vertebrae and pelvis. Ubelaker and Buikstra (1994) recommends that warping be recorded as present or not. This was not felt to be useful in the case of the material used, as all of it showed some degree of warping. For that reason, warping was scored based on a four-tier scale where 0 was no warping, as seen on an unburnt bone, 1 was light warping, 2 was moderate warping and 3 was marked warping.

After a trial period, it was concluded that this method was unfeasible. It was very difficult to categorise the warping, as the amount of warping seemed to be associated mainly with relative fragment size and the level of preservation. In deposits with a generally large fragment size, warping was more evident, whereas in deposits with smaller fragments, warping was less easy to detect. This was probably due to fragments breaking at the points where warping had occurred.

Like warping, fracture patterns were only scored for limb bones and skull bones, due to the fact that most research on this topic has been conducted on either longbones (the bones of the arms and legs, except the patella and the pelvis) or skull bones. The fracture patterns were classified based on the classes suggested by Fairgrieve (2008, 50): patina, longitudinal, curvilinear, transverse and delamination fractures.

After a trial period, the recording of fracture patterns was abandoned, and not included in the thesis. It was doubtful whether reliable data could be obtained from fracture patterns, as they are no longer seen as providing reliable information on whether the body was fleshed or not at the time of death Buikstra and Swegle (1989, 256). Furthermore, it was difficult to classify the fracture patterns, as more than one type of fracture pattern could occur on a single fragment.

4.2.6 Pyre/grave goods

Modern cremation is performed on bodies with very little associated material culture, generally only the coffin and any surgical implants present in the body (Schultz et al., 2008). Pre- and protohistoric cremations differ from modern cremations in this respect. There is no reason to believe that cremation burials would have been 'poorer' than inhumation burials, but the treatment of the artefacts would have been different (McKinley, 2006). A famous 9th century AD account of a Rus (Scandinavian people living in Russia) chieftain cremation mentions the dead man being burnt with a very rich assemblage including a complete ship, personal possessions, several animals and a slave (Parker Pearson, 1999a, chapter 1). In an inhumation burial, much of the organic material would be lost. One would expect an even greater loss if organic materials were put on the funeral pyre. Furthermore, the remains of all objects placed on the pyre need not have been included in the burial (McKinley, 1994a, 132).

A distinction is often made between pyre goods, which are the artefacts that were included on the pyre, and grave goods, which have been added at burial. That objects appear to be unaffected by fire need not mean that they have not been on the pyre, as they may have fallen out into a less hot part of the pyre (McKinley, 1994c, 91). Pyre goods are easily missed if the cremations are not carefully analysed. Animal bones, antler and bone artefacts can potentially be difficult to distinguish from human bone (McKinley, 1994a, 133). However, it is not impossible, and even quite small pieces can be identified as non-human bone (Whyte, 2001), even if identifying the species might require a specialist. Animals could be added to the pyre as parts, such as meat bones, or as complete animals. Pyre goods may give other important clues about the mortuary ritual.

Several large animal carcasses would imply a significantly larger pyre (Bond, 1996). Melted glass beads give a minimum temperature reached by the pyre (Wells, 1960, 36). The presence of melted glass from necklaces on the phalanges of the hand indicates that the hands of the cremated person were placed over the chest (McKinley, 1994c, 83-84). The types of pyre goods normally associated with Bronze Age urned cremation burials are addressed in the next chapter.

For this thesis, pyre goods were recorded in a separate category, including a description of each object and the weight. Animal bones were generally not identified to species level, the only distinction was made between worked and unworked bone. Some of the animal bones encountered were examined by zooarchaeologist Sheena Fraser at the University of Edinburgh in order to determine species. The only other pyre goods encountered were a few fragments of flint, which were not studied by a specialist.

Weights and descriptions of other inclusions were also recorded. Inclusions comprised material that were not human bone and could not be classified as pyre goods. This included charcoal and pottery (mostly fragments of the urn, although it cannot be ruled out that some fragments may have belonged to accessory vessels).

4.2.7 Pathology and trauma

The understanding of pathological conditions in bone requires comprehensive knowledge of the anatomy and normal variations of bone. The repair and remodeling of bones is the result of the actions of osteoblasts, bone forming cells, and osteoclasts, which break down and resorb bone tissue (Ortner and Turner-Walker, 2003). In normal bone turnover, there is a balance between the activity of osteoblasts and osteoclasts, so that bone is maintained (except in old age) (Tuross, 2003). In contrast, pathological lesions are a result of the imbalance between bone formation and destruction. This may be caused by both systemic and local factors, including pathogenic organisms (Ortner, 2003). Skeletal manifestations of disease include abnormal bone formation and abnormal bone destruction, as well as abnormal size and shape of bones (Ortner, 2008). It is important to determine that what appears to be pathological changes are simply not non-metric changes (natural variation) or pseudo-pathologies caused by taphonomic factors during the time the human remains were deposited (Ortner, 2003). Normal bone growth in children is complex. Due to the disorganised nature of the immature bone on the periosteal surface, it is impossible to distinguish between normal and diseased bone in the very young (Lewis, 2000).

In contrast to the skeleton, the teeth are exposed and interact directly with the environment (Ogden, 2008, 284). The dentition has a different structure than the skeleton, and consists of dentin and enamel. Both dentin and enamel are stronger, more resistant materials than bone due to their very low porosity. An important difference in enamel is that it lacks cells, and therefore it is incapable of repairing itself when damaged (Turner-Walker, 2008). The enamel of the teeth is normally the most resistant element of the human body (Ogden, 2008). However, it shatters during the cremation process (Shipman et al., 1984).

The aim of the analysis of skeletal lesions is to identify the disease process, something that is often impossible (Ortner, 2003). The understanding of ancient diseases is based on comparison with skeletal remains with known diagnoses, as well as with living individuals. Ancient diseases, just like modern ones, can be recognised and diagnosed (Waldron, 1998). As in clinical medicine, diagnosis in palaeopathology is based on the understanding of the skeletal manifestations of a specific condition (Grauer, 2008). The ways in which diagnoses are reached differ based on whether the individual is alive or dead. In the living, a wider variety of diagnostic criteria are available. The list of diagnostic criteria in skeletons is reduced to gross morphology and radiography (Waldron, 1998). In order to be able to compare data on past diseases it is helpful if the data is obtained by similar means. Currently the only links between diagnosis in the living and in skeletal remains are radiographic evidence (Rogers and Waldron, 1995) and to some extent histology (Bell and Piper, 2000). In order for diagnoses to be comparable between different practitioners, they need to be based on data recorded in a standardised manner (Grauer, 2008). The lack of standardised recording in palaeopathology makes it difficult, if not impossible to compare older diagnoses with those from material analysed more recently. This is regrettable as the criteria for diagnosing conditions change over time (Waldron, 1998).

In theory, pathologies and trauma can be identified from cremated remains just as from unburnt remains (Gejvall, 1947; Reinhard and Fink, 1994; Sigvallius, 1994; Holck, 2008). In practice, the amount of information that can be gained from a cremation deposit depends on the particular taphonomy and the resulting condition of the specific deposit (Reinhard and Fink, 1994). As in all types of cremation analysis, the main stumbling blocks for the identification of pathological lesions are the fragmentation, warping and discolouration of the remains (Holck, 2008). Various different skeletal lesions resulting from a clinically known syndrome can easily be missed in unburnt remains (Anderson, 2000). The fragmentation, and sometimes intermingling of various individuals, that occur in cremation burials compounds this problem. The warping and discolouration of cremated remains further complicates the identification of specific lesions as changes in shape and colour caused by burning can mask those caused by pathology.

More specific problems affecting the identification of pathological lesions are the fragmentation of the crowns of erupted teeth (Beach et al., 2008). Fissures and fractures caused by the cremation process can be confused with damage from perimortem trauma (Fairgrieve, 2008). The loss of erupted tooth crown means that dental pathologies will be underrepresented in a cremated population compared to an unburnt one, as only lesions visible on the root, or affecting the surrounding bone, will be detected. The problem of differentiating perimortem trauma from fissures and fractures caused by the cremation process is of crucial importance in forensic cases, where the perpetrator might burn the body of a victim to destroy the evidence of the crime. However, perimortem trauma will retain its specific signature even after burning, including sharp margins, beveling and diverse fracture patterns (Herrmann and Bennett, 1999; Pope and Smith, 2004). Research replicating specific forms of sharp force trauma, such as chop marks (de Gruchy and Rogers, 2002) and saw marks (Marciniak, 2009) suggested that these were identifiable even after burning. However, more research is needed, as all research is performed on fresh, fleshed bone. It is not known whether perimortem trauma on bone burnt when already defleshed and dry would be as easily detected (Fairgrieve, 2008). Both healed sharp force trauma (Gejvall, 1947) and perimortem sharp force trauma (Holck, 2008), have been identified in archaeological populations.

It is important to remember that the lesions identified on cremated remains are only the tip of the iceberg. Holck (2008) suggested that only c. 10% of diseases leave marks on the skeleton, and even fewer can be identified from cremated remains. Despite the problems associated with identifying pathological changes and trauma in cremated bones, many have been identified from pre- and protohistoric cremation burials. The most commonly found tend to be lesions related to degenerative disease, including lesions of the spine and joints (Reinhard and Fink, 1994). These typically include Schmorl's nodes, pitting in the vertebral bodies caused by herniations of the intervertebral discs (Resnick and Niwayama, 1978); and osteophytes, new bone growth on the margins of the vertebral bodies caused by the rupture of the fibrous capsule of the intervertebral discs (Nathan, 1962). Porotic hyperostosis and cribra orbitalia, pitting in the outer table of the cranial vault and in the orbital roof, lesions that have been linked to anaemia (Walker et al., 2009), are also commonly found.

Holck (2008) used x-rays to study Harris lines of arrested development, another marker of poor health, in Norwegian Iron Age graves. He found them in a third of the 102 sampled graves, but reasoned that they were seriously underrepresented because of the problems with selecting suitable fragments for analysis. Although dental pathologies are also underrepresented, lesions affecting tooth roots, dentin and surrounding bone can be identified. In a study of 100 Hohokam cremation burials from Arizona, Merbs (1967) identified a number of dental pathologies and non-metric variation. This included unspecified alveolar disease, evidence of traumatic tooth loss, congenital absence of the third molar, crowded teeth and non-metric variations of the tooth roots on premolars and molars. McKinley (1994c) identified a wealth of pathological lesions from Spong Hill. This included Schmorl's nodes as well as rarer conditions such as diffuse idiopathic skeletal hyperostosis (DISH), gall stones and calcified lymph nodes.

For this thesis, pathologies and non-metric traits were described and recorded in the database, but diagnoses were not attempted.

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Chapter 5

Results

5.1 Weight, fragmentation and identification rate

The total bone weights of the deposits (counting only bone fragments over 2 mm, and not inclusions) range between 11g and 2710g (Table 5.1). The weight distribution is positively skewed (Figure 5.1), with 44 deposits falling below 480g. The median weight (340g) is therefore a better measure of central tendency than the average (604.7g). In most cases, all of the four elements of the skeleton (skull, axial skeleton, upper and lower limb) were present among the identified fragments. Cases where one of the parts was missing tended to be the smaller deposits. Skull fragments were less likely to be missing.

On average just under half (45.2%) of the bone fragments by weight could be identified (Figure 5.2).

The level of fragmentation is summarised in Table 5.3. Most of the material by weight (63.9%) falls into the >10 mm sieving fraction. Only in 14 deposits

	Initial weight (g)	Total bone weight (g)	Total identified bone weight (g)	Identified by weight (%)	Total identified frags (g)	Skull frags (g)	Axial frags (g)	Upper limb frags (g)	Lower limb frags (g)
Min	23	11	7	13.4	3	0	0	0	0
Max	3590	2710	905	100	234	390	135	177	296
Median	456	340	148	43.4	33	71	10	25	45
Avg	764.3	604.7	236.2	45.2	45.5	101.3	22.8	39.8	73
St Dev	760.6	597.9	222.8	18.1	46.3	89.8	28.8	43.4	81.1
Total	57321	45350	17716	-	3409	7601	1713	2985	5477

Table 5.1: Summary table of deposit weights.

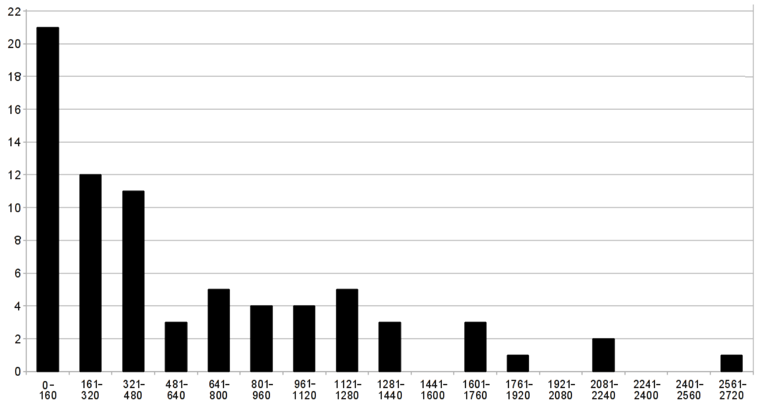

Figure 5.1: Histogram of deposit weights, showing positive skew.

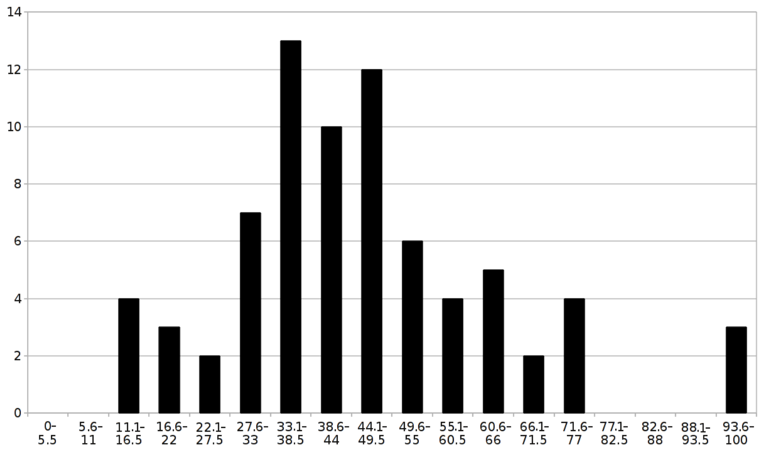

Figure 5.2: Histogram showing percentage of material identified by weight per deposit. Apart from three outliers approaching 100% identification, the data fits the normal distribution well.

	>10 mm	5-10 mm	2-5 mm	Total
Grams	30483	13519	3686	47688
Percentage	63.9	28.3	7.7	100

Table 5.2: The relative distribution of sieving fractions.

>10 mm (%)	Avg longest cranial frag (mm)	Avg longest post-cranial frag (mm)
63.9	49.32	67.74

Table 5.3: Level of fragmentation, expressed through percentage of material of >10 mm and longest cranial and post-cranial fragments.

Longest cranial fragment	Count	Min. Length	Average	Max. Length	St. Dev.
Skull vault	19	22.81	45.54	70.22	11.71
Parietal	17	7.99	55.65	98.97	18.49
Occipital	13	44.4	54.61	69.44	8.14
Mandible	8	37.76	53.39	93.6	17.25
Frontal	6	25.36	34.87	40.38	6.29
Temporal	5	30.27	39.27	48.67	7.06
Total	68	7.99	47.22	98.97	-

Table 5.4: Longest cranial fragments.

did the >5 mm fraction weigh more than the 10 mm fraction.

As part of the standard procedure, the longest cranial and post-cranial fragments of each deposit were measured using a sliding caliper. These measures are presented in Tables 5.4 and 5.5. Overall, the longest fragments in each deposit rarely measured over 100 mm. The longest fragment overall, and the longest post-cranial fragment, was a piece of ulnar shaft, measuring 135 mm. In general, the cranial fragments were shorter, and the longest cranial fragment was a fragment of parietal, measuring 99 mm.

5.2 Minimum number of individuals (MNI)

A minimum of 103 individuals were identified from the 75 deposits. The majority of deposits, 51, contained only a single individual. 20 deposits contained a minimum number of two individuals and four deposits contained a minimum number of three individuals, resulting in 32% of deposits containing more than one individual.

5.3 Sex determination

As expected, estimating the sex of individuals proved more difficult than estimating age, as only the pelvis and skull can be used for reliable estimations of

Longest post-cranial fragment	Count	Min length	Max length	Avg length	St Dev
Femur	23	27.28	117.3	62.64	20.72
Humerus	15	24.11	101.82	66	20.2
Radius	10	38.38	99.74	70.57	21.64
Ulna	7	57.52	134.74	93.8	30.29
Iliac crest	3	66.16	84.35	75.32	9.096
Rib	3	16.46	62.36	37.55	23.18
Tibia	3	74.47	114.68	89.92	21.66
Fibula	2	68.03	83.7	75.87	11.08
Lumbar vertebrae	1	44.4	44.4	44.4	-
Scapula	1	38.2	38.2	38.2	-
Thoracic vertebra	1	37.85	37.85	37.85	-
Total	69	16.46	134.74	62.92	-

Table 5.5: Longest post-cranial fragments.

Group	Skeletal element	Sex indicator	Count	Percentage
Skull	Frontal bone	Supraorbital margin	42	40
Skull	Mandible	Robusticity	8	7.6
Skull	Temporal bone	Mastoid process	8	7.6
Skull	Occipital	Robusticity	7	6.7
Skull	Mandible	Mental eminence	5	4.8
Skull	Frontal bone	Glabella	4	3.8
Skull	Parietal	Robusticity	2	1.9
Skull	Mandible	Gonial angle	1	1
Skull	Maxilla	Robusticity	1	1
Skull	Occipital	Nuchal crest	1	1
Pelvis	Illium	Greater sciatic notch	13	12.4
Pelvis	Pubis	Inferior ramus	1	1
Limb	Humerus	Robusticity	8	7.6
Limb	Femur	Robusticity	3	2.9
Limb	Patella	Robusticity	1	1

Table 5.6: Distribution of sex indicators on 105 fragments.

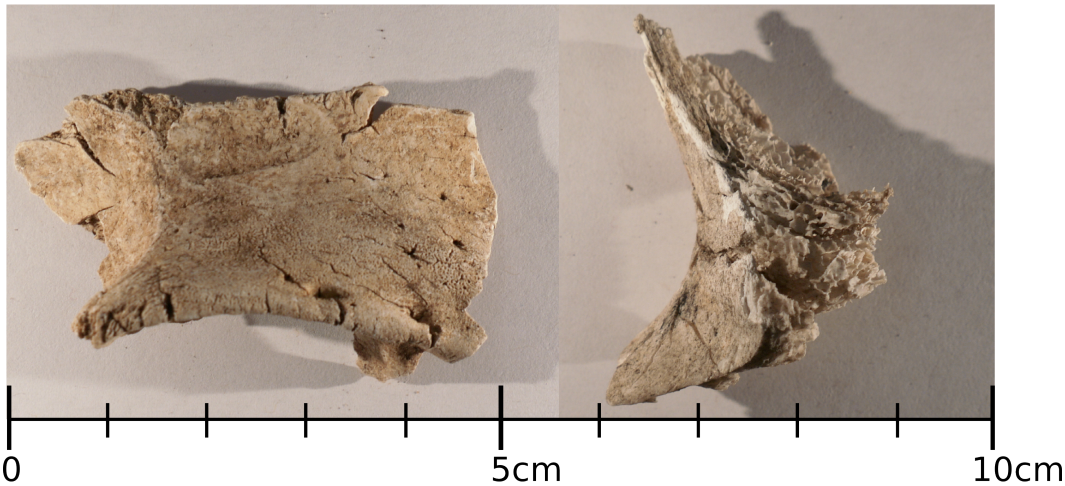

Figure 5.3: Fragments used for sex determination. Supraorbital margin, male, Cairnpapple EP 178. Greater sciatic notch, female, Kirkpark EA 144.

sex. This is clearly seen in the number of fragments with sex indicators (105) compared to those with age indicators (1608).

Out of the 15 indicators identified and used to determine sex, ten were found in the skull, two were found in the pelvis and three in the limbs (see Table 5.6). Seven of the indicators could be scored on a scale from one to five, where one was markedly female and five markedly male. In the remaining eight, very marked robusticity was taken to indicate male sex.

The indicators from the skull were divided evenly between those which could be scored, including supraorbital margin, mastoid process, mental eminence, glabella and nuchal crest, and those which could not, including the frontal bone, the parietal bone, the occipital bone, the maxilla and the gonial angle of the mandible. The most common was the supraorbital margin, which was used on 42 occasions. The other indicators were all used less than ten times. Each of the gonial angle, the maxilla and the nuchal crest were only used once as sex indicators. Examples of sexed fragments can be seen in Figure 5.3.

Sex indicators in the pelvis were much rarer than those in the skull. Both of the indicators identified, i.e. the greater sciatic notch and the inferior ramus of the pubis, were ones which could be scored. The greater sciatic notch was identified and complete enough to be scored in 13 cases. The inferior ramus of the pubis was only complete enough to be scored in one case. Sex indicators

Sex	Count	Percentage
Unknown, non-adult (??)	29	28.2
Unknown, adult (??)	36	35.0
Male (?m)	22	21.4
Female (?f)	16	15.5
Total MNI	103	100

Table 5.7: Determined sex for all 103 individuals.

Aging indicator	Count	Percentage
Epiphyseal closure	49	65.3
Sutural closure	44	58.7
Size and morphology	30	40
Dentition	28	37.3
Morphological changes	15	20
Total deposits	75	-

Table 5.8: Observed aging indicators for all 75 deposits.

in the limbs were only cases of extremely large and/or robust elements, which could be assumed to indicate maleness. This was recorded eight times from the humerus, including both the head and the shaft; three times from the femur (femoral shaft only) and once from the patella (overall size).

Out of the 103 identified individuals, sex could only be determined with any degree of certainty on 38 of them, as seen in Table 5.7. Due to the paucity of sex indicators, especially those of the pelvis, no individuals could be sexed with absolute certainty. The individuals were therefore identified as either probable males (22) or probable females (16). This left 65 individuals of unknown sex. 36 of these individuals were classed as adults and could not be assigned to a sex due to a lack of reliable sex indicators, or conflicting and/or ambiguous sex indicators. The remaining 29 individuals were juveniles. The low number of sexed individuals suggests that sex will be a less useful variable than age when analysing the results.

5.4 Age determination

The recorded aging indicators can be grouped into five categories: epiphyseal closure; sutural closure; size and morphology; dentition, and morphological

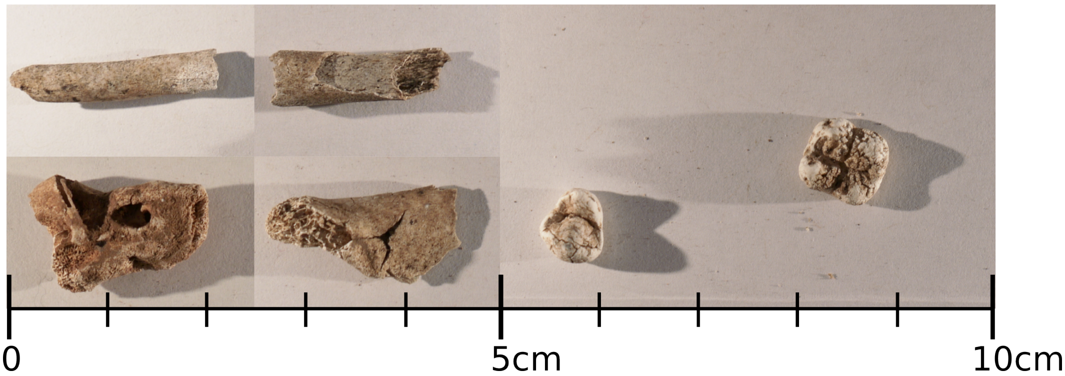

Figure 5.4: Examples of fragments used for age determination. Clockwise: infant longbones, Westwood EA 60; unerupted tooth crowns, infant, Mill of Marcus EQ 314; unfused coracoid of the scapula, infant, Mill of Marcus EQ 314; petrous part of the parietal bone, infant, Magdalen Bridge EA 39.

changes, as seen in Table 5.8. Epiphyseal closure denotes fusion of skeletal elements as an individual grows and develops. Sutural closure refers to the sutures of the cranial vault. Size and morphology groups together observations including the thickness of the skull vault or the cortical bone of long bones and the size and shape of specific skeletal elements. In the cases of complete skeletal elements (from infants/neonates) measurements were taken, even though an unknown amount of shrinkage makes it problematic to use such measurements to make specific estimates of age. Dentition refers to the presence of tooth roots/tooth sockets as well as unerupted tooth crowns. Morphological changes refers to changes which continue even as the skeleton has finished growing, including the auricular surface and the pubic symphysis. Examples of aging indicators encountered in the analysed material can be seen in Figure 5.4 (infant bones), Figure 5.5 (adult dentition) and Figure 5.6 (child/adolescent and adult age indicators).

The pubic symphysis and auricular surface were rarely found, as seen in Table 5.9. Due to fire damage, the age ranges suggested by the morphological changes to these elements were broad. Dentition, especially unerupted tooth crowns, was useful for determining age in younger juveniles, but not for adults. The size and morphology of elements, especially of the skull, were useful for determining age in the youngest children and foetuses/infants. Other indicators in this category, such as the thickness of the skull vault or of longbone shafts,

Figure 5.5: Examples of fragments used for age determination. Dentition, adult male, unregistered cremation, Fetteresso.

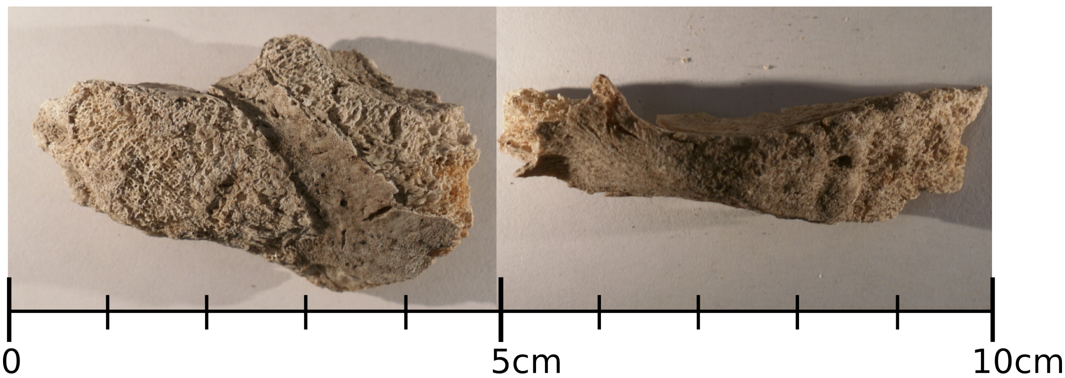

Figure 5.6: Age indicators. Unfused ischium, child/adolescent Tuack EP 6. Pubic symphysis, Kirkpark EA 146.

Aging indicator	Count	Percentage
Size and morphology	654	6.1
Epiphyseal closure	413	3.8
Sutural closure	404	3.8
Dentition	102	0.9
Morphological changes	35	0.3
Total fragments with aging indicators	1608	14.9
Total fragments	10762	100

Table 5.9: Observed age indicators for all 10,762 identified fragments.

Age group	Count	Percentage
Adult (over 18 or cessation of growth)	71	68.9
Child/adolescent (3-18 or until cessation of growth)	24	23.3
Foetal/infant (less than 3 years)	8	7.8
Total MNI	103	100

Table 5.10: Determined age groups for all individuals.

were frequently registered in the database, but could only be used to separate the bones of young children from those of older juveniles/adults. Epiphyseal closure was useful in estimating the age of juveniles and young adults, although unless several fused and unfused epyphyses were found, it could be difficult to determine whether an individual was a child or an infant. Sutural closure, despite being frequently found, was the least useful indicator. It was only ever used to determine an adult from a young child, and this could be achieved just as easily by the thickness of the skull.

As seen in Table 5.10, all of the 103 identified individuals could be assigned to one of the three age categories: adult (more than 18 years or cessation of growth), child/adolescent (3-18 years or until cessation of growth) and foetal/infant (less than 3 years). The majority, 71, of the identified individuals were classed as adults. 24 of the individuals were classed as children/adolescents. Only eight individuals were classed as foetal/infants.

MNI	Sex	Count	Percentage
1	Unknown (??)	30	46.2
2	Unknown (??)	24	36.9
3	Unknown (??)	11	16.9
1	Male (?m)	11	50
2	Male (?m)	11	50
3	Male (?m)	0	0
1	Female (?f)	10	62.5
2	Female (?f)	5	31.3
3	Female (?f)	1	6.3

Table 5.11: Sex by MNI in deposits.

Sex	Avg weight (g)	Range	St. Dev.
Male (?m)	474	36-1330	465.2
Female (?f)	420.9	62-1238	415.9
Unknown (??)	193.3	12-811	194.1

Table 5.12: Total (unidentified+identified) bone weight by sex.

5.5 Age and sex distribution in individual deposits

5.5.1 Sex and weight versus type of burial

Males are equally represented in single as well as in double deposits. There are no identified males in the triple deposits. Females are most common in the single deposits, and slightly less common in the double deposits. Only one identified female occurs among the individuals in the triple deposits. However, as seen in Table 5.11, the relatively small proportion of individuals of known sex make these results problematic.

Deposits containing probable males weighed more than deposits containing probable females, which in turn weighed more than deposits in which the individual could not be sexed. It is possible that the low weight of the individuals of unknown sex contributes to the problem in determining sex, as there are fewer potential sex indicators. However, it is also likely that the number of non-adults, who are likely to be smaller than adults, in this category is a factor. The figures are presented in Table 5.12.

MNI	Age	Count	Percentage
1	Adult	43	60.6
2	Adult	25	35.2 s
3	Adult	3	4.2
1	Child/adolescent	6	25
2	Child/adolescent	11	45.8
3	Child/adolescent	7	29.2
1	Foetal/infant	2	25
2	Foetal/infant	4	50
3	Foetal/infant	2	25

Table 5.13: Age group by MNI in deposits.

Age	Avg weight (g)	Range	St. Dev.
Adult	312.9	12-1330	339.8
Child/adolescent	278.8	16-994	359.2
Foetal/infant	48.5	13-84	50.2

Table 5.14: Total (unidentified+identified) bone weight by age.

5.5.2 Age versus MNI

The majority, roughly 60%, of adults were found in deposits with an MNI of one. Over one third of adults were in the MNI=2 category. Only just over 4% were found in the MNI=3 category. For the non-adults, the ratio was different. For children/adolescents, only a quarter of the individuals were found in the deposits with an MNI of one. The majority, almost 46%, were found in the MNI=2 category. Just over 29% of the individuals were found in the MNI=3 category. For foetuses/infants, a quarter of the individuals were found in the MNI=1 category, half in the MNI=2 category and a quarter in the MNI=3 category. When both non-adult age categories (children/adolescents and foetuses/infants) are put together, it is clear that juveniles were overrepresented in the urns containing more than one individual, whereas adults are more commonly occurring in single graves.

5.5.3 The relation between age and weight where MNI=1

Deposits from urns containing adults weighed more than urns containing non-adults. The weight of deposits where MNI=1 containing adults ranged quite widely, from 12-1330 g. The weight range of those containing children/adolescents

Individual	Pathology	Age	Sex
1	Tooth loss and lipping on vertebrae.	Adult	?M
2	Third molar missing	Adult	?M
3	Schmorl's nodes	Adult	??
4	Schmorl's nodes and worn teeth	Adult	?F
5	Schmorl's nodes	Adult	?F
6	Schmorl's nodes and lipping on vertebrae	Adult	?M
7	Possible tooth loss and pitting in sinus.	Adult	?M
8	Pitting on thoracic vertebrae	Adult	?M
9	Lipping in thoracic vertebrae	Adult	?M
9	Lipping on vertebrae	Adult	??
10	Lipping on vertebrae	Adult	?M
11	Lesions in spine and ribs	Child/adolescent	?F
12	Lesions in spine	Adult	??
13	Lipping on dens of axis	Child/adolescent	??
14	Pitting on thoracic vertebrae	Adult	??
15	Dental abscesses, lipping and schmorl's nodes	Adult	??
16	Crowded teeth, third molar missing and lesion in arm	Adult	??

Table 5.15: Pathologies.

was 16-994 g. For deposits containing foetal/infant remains, the range was narrower, only 13-84 g. When looking at the average weight, there was less difference between the adult category and the child/adolescent category than between the adult or child/adolescent and the foetal/infant category. It is likely that this is related to body size and not only taphonomy.

5.6 Pathology and non-metric variation

Out of 103 identified individuals, only 16 showed any sign of pathology. This has to be taken as an absolute minimum, considering that the cremation process, with its resulting destruction and fragmentation, is likely to obliterate some signs of pathology. The pathologies observed were mainly restricted to those affecting the spine and teeth.

Pathologies of the spine were identified in 14 individuals. Pathologies of the vertebrae were mostly represented by Schmorl's nodes and various types of pitting and lipping (osteophytes). Schmorl's nodes were identified in five individuals. Lipping and new bone formation was identified in seven individuals. Pitting and other lesions not specific enough to be labeled Schmorl's nodes occurred in four individuals. Examples of pathological lesions identified can be

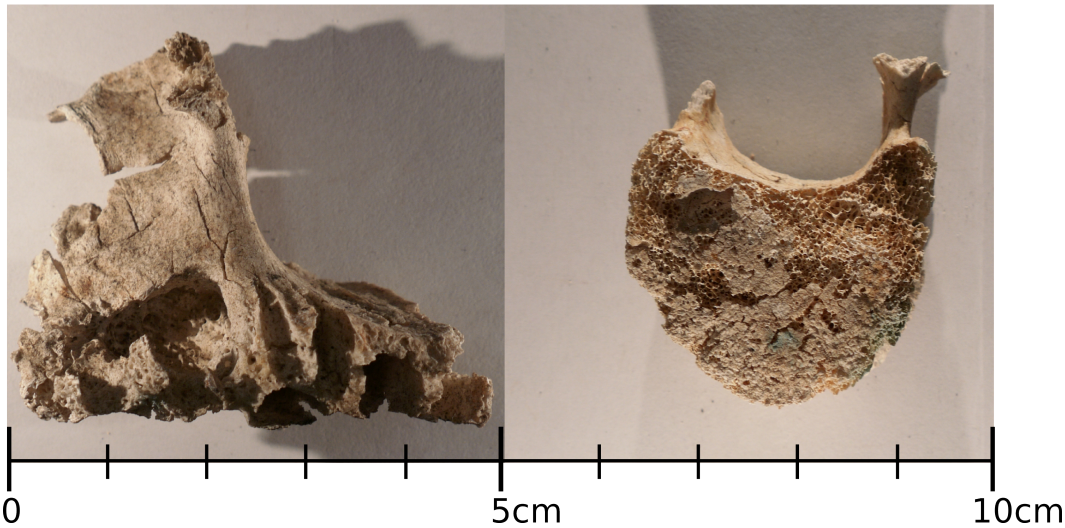

Figure 5.7: Examples of pathological lesions. Dental abscess, maxilla, Kirkpark EA 144. Schmorl's nodes, thoracic vertebra, Pinkie Mains West EA 235.

seen in Figure 5.7.

Dental pathologies/non-metric variation were observed in six individuals. There were two cases of missing third molars in adults. This is more likely to be a case of non-metric variation rather than a result of tooth loss. One of these individuals also exhibited crowded teeth, which would not necessarily have caused any symptoms. One individual showed signs of tooth loss, and one showed signs of possible tooth loss. Another individual had severely worn teeth. Yet another had evidence of dental abscesses. Other pathologies identified were much rarer. One individual showed evidence of pitting/lesions on the ribs. Another had pitting inside the frontal sinuses. A third individual had new bone formation on a radius. It is impossible to reach any sort of conclusion about the health of the Bronze Age population of Scotland from this, partly due to the small sample, but also due to the poor survival of pathological lesions in cremated remains.

5.7 Poor calcination

5.7.1 Defining poor calcination

Poorly calcined fragments are defined as fragments which were partly or completely grey or black and where this colour was not due to discolouration in the ground or soot, but due to insufficient heat or oxygen supply, causing organic matter to remain in the bone. Areas of poor calcination on fragments were recorded in the database, stating the degree of poor calcination as suggested by colour (light-, mid- and dark grey, where darker colour suggested poorer calcination), the position of the area of poor calcination (on the surface, sandwich effect) and, if possible where on the bone (such as the shaft or the head of a longbone). In total, roughly a quarter of the identified fragments showed areas of poorly calcined bone. In the following sections, the frequency and patterns of poor calcination are discussed in relation to geographical distribution, sex and age as well as a detailed discussion on calcination patterns in the body.

5.7.2 Deposit-level variation

14 deposits with less than 30 identified fragments were excluded from analysis. The level of poor calcination in the remaining 61 deposits varied. Six deposits, including Glenluce BHA 155, Old Keig EP 48, Udny EA 121, Quarryford Farm EA 56, Howford Farm 2 and Denbeath EQ 590 showed 1% or less of poor calcination among the identified fragments. Six deposits, including Carnousie EA 47, Glenluce BHA 154, Drumshargard EA 1, Saxe Coburg Place EA 3, Kirkpark EA 146 and Gilchorn EQ 222 showed over 60% of fragments with poor calcination.

5.7.3 Sex/age variation

In order to analyse the effect of age and sex on calcination, only deposits with an MNI of one were selected. This is because it is not possible to determine which fragments belong to which individual in a multiple burial. This left a little less than half of total identified bone fragments. The analysis suggested that the ?males (a total of 1253 fragments) were slightly better calcined than the ?females (a total of 1145 fragments), which in turn were slightly better calcined than the

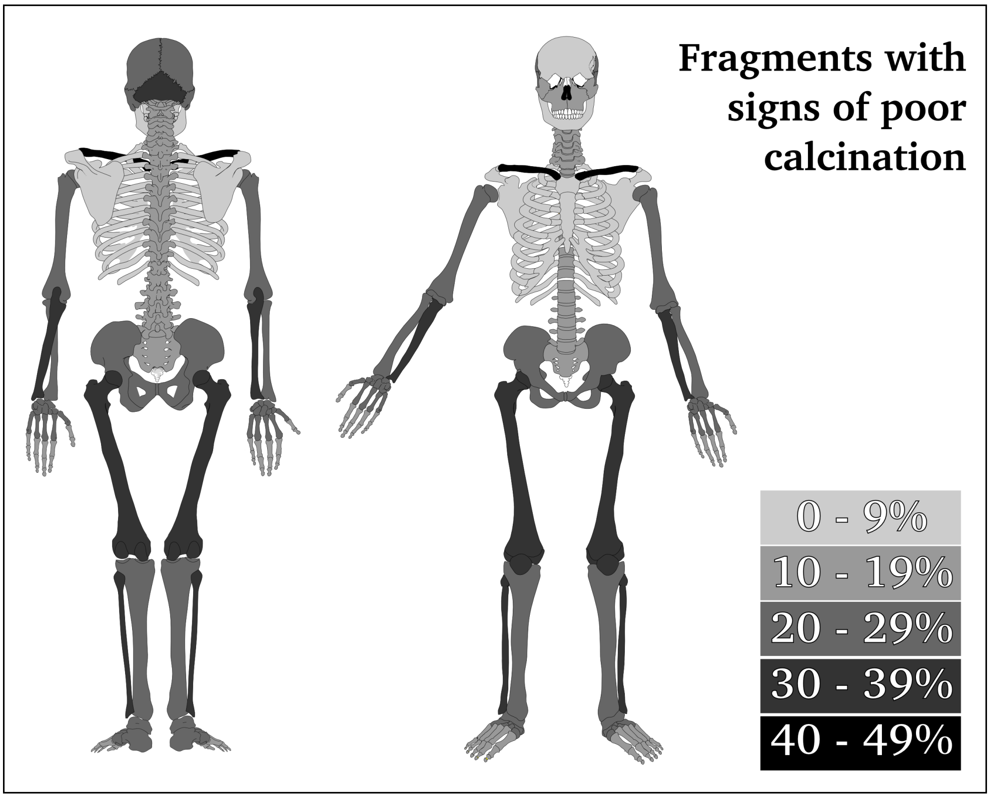

Figure 5.8: The degree of poor calcination for areas of the body, based on skeletal element for the whole material.

individuals of unknown sex (a total of 2187 fragments). When separated into rough age categories (adult, child/adolescent, infant/foetal) the data suggested that adults showed the lowest degree of poor calcination (less than 20%), with children/adolescents having higher levels of poor calcination (over 30%) and infants having the highest degree of poor calcination (over 70%). However, generalising is difficult, due to the small material.

5.7.4 Distribution of poorly calcined bone in the body

In order to understand the distribution of poor calcination in the body, it was necessary to investigate different units of analysis. Calcination patterns were searched for based on a division of the body into its main four areas (skull, axial skeleton, upper and lower limbs), on single bones or groups of bones and finally on different areas of the longbones (proximal end, shaft and distal end).

Body element	Grouping	Total frags	Poorly calcined frags	%
Upper limb	Scapula	92	5	5.4
Axial	Thorax	1402	98	7
Skull	Mandible	268	23	8.6
Skull	Frontal	88	8	9.1
Skull	Zygomatic	55	5	9.1
Axial	Thoracic vertebrae	335	31	9.3
Lower limb	Foot phalanges	52	5	9.6
Skull	Unspecified	178	18	10.1
Axial	Lumbar vertebrae	74	8	10.8
Axial	Sacrum	108	12	11.1
Lower limb	Os coxae	383	50	13.1
Skull	Maxilla	98	13	13.3
Axial	Cervical vertebrae	175	25	14.3
Skull	Temporal	440	85	19.3
Upper limb	Hand phalanges	437	85	19.5
Lower limb	Foot	188	42	22.3
Lower limb	Tibia	178	40	22.5
Upper limb	Humerus	336	81	24.1
Upper limb	Hand	180	44	24.4
Skull	Parietal	353	96	27.2
Upper limb	Radius	212	60	28.3
Lower limb	Femur	566	175	30.9
Skull	Skull vault	3566	1122	31.5
Lower limb	Fibula	117	37	31.6
Skull	Occipital	170	56	32.9
Lower limb	Patella	30	10	33.3
Upper limb	Ulna	154	54	35.1
Upper limb	Clavicle	49	20	40.8

Table 5.16: Presence of poorly calcinated fragments by skeletal element.

Similarly, the analysis of the degree of poor calcination was divided into two stages. In the first stage, all calcination was considered. In the second stage, different grades of calcination (light-, mid- and dark grey) were considered.

Poor calcination was distributed unevenly throughout the body. Although the percentage of fragments with evidence of poor calcination was similar in the skull (see Table 5.7.4 and Figure 5.8) and upper- and lower limbs, it was significantly lower in the axial skeleton. The percentage of fragments with poor calcination was highest in the skull. A total of 24% of the skull fragments showed signs of poor calcination. Over half of the poorly calcined fragments showed the lowest degree of poor calcination, light grey. Mid-grey was more unusual, with only 3% of the fragments affected. Dark grey was more common, with 7% of the fragments affected.

Of the individual bones or groups of bones in the skull, the highest amount of poor calcination was found in the occipital fragments. Over 35% of the occipital fragments showed signs of poor calcination. Skull vault fragments which could not be identified as belonging to a particular skull vault bone were relatively poorly calcined and only slightly better calcined than the occipital fragments. The percentage of fragments with evidence of poor calcination of the parietal bone was just over 25%, whereas it was 19% for the temporal. The bones of the face, including the frontal, mandible, maxilla, unspecified skull fragments (fragments of the facial skeleton which could not be identified down to specific bone) and zygomatic showed significantly higher levels of calcination. The percentage of fragments with poor calcination among these bones ranged between less than 10% and up to just over 15%.

The axial skeleton was generally well calcined, with only 6% of the fragments showing any sign of poor calcination. Light grey discolouration, the mildest form of poor calcination, and mid-grey were equally common in the axial skeleton, both occurring on around 3% of the fragments. Less than 1% had any dark grey poor calcination. Poor calcination was most frequent in the cervical vertebrae, in which over 10% of the fragments were affected. The sacrum and lumbar vertebrae showed slightly higher levels of calcination, both around 10%. The thoracic vertebrae had slightly higher levels of calcination. The thorax, which included mostly rib fragments as well as a smaller quantity of sternal fragments, showed the highest level of calcination, with less than 10% of these fragments showing any indication of poor calcination. A comparison between vertebral bodies and the neural arches found no significant difference in calcination between these two parts.

In the upper limb, 23% of the fragments had signs of poor calcination. Over 15% of the fragments were light grey, 6% were mid-grey and just under 2% were dark grey. Poor calcination was most frequent in the clavicle, which w skeletal element with the highest percentage of poor calcination in the entire body. Over 40% of the clavicle fragments showed signs of poor calcination. The ulna was slightly better calcined, but still had over 30% of fragments affected by poor calcination. The percentage for the radius was just under 30%. The hand (carpals and metacarpals) and humerus showed a similar degree of poor calcination, at around 25%. Of the hand phalanges, just under 20% of the fragments were affected by poor calcination. The scapula was the skeletal element in the body which had the lowest percentage of poor calcination, as less than 5% of the fragments were affected.

22% of the lower limb fragments showed signs of poor calcination. Around 13% were light grey, 6% were mid-grey and just over 2% were dark grey. In the lower limb, the patella had the highest percentage of fragments affected by poor calcination, with over 30% of the fragments affected. The femur and the fibula both had slightly lower levels of poor calcination, with just over 30%. The tibia and the foot (tarsals and metatarsals) both had just over 20% of fragments affected by poor calcination. Just over 10% of the fragments of the os coxae were affected by poor calcination. Among the fragments of the foot phalanges, just under 10% were affected.

For the longbones (humerus, ulna, radius, femur, tibia and fibula) the area affected by poor calcination was analysed. The bones were divided into proximal end, distal end and shaft. As there were too few fragments of each part from tibia, fibula and ulna (less than 200 fragments), these were not analysed.

For the femur, the distal end of the bone had the highest percentage of poorly calcined bone, with 40% of the fragments affected. The majority of these, over 30%, were light grey. Just under 10% of the fragments were mid-grey and the rest were dark grey. In the shaft approximately 30% of the fragments were poorly calcined. The majority, 17%, were light grey. Of the remainder, 6% were mid-grey and 7% dark grey. The proximal end was the part with the smallest percentage of poorly calcined bone. Only 15% of the fragments were poorly calcined. Of these, 6% were light grey, 6% mid-grey and 3% dark grey.

On the humerus, the proximal end was the part with the highest percentage of poorly calcined bone, with just under 30% of poorly calcined bone. A little more than half of this was light grey and the rest was mid-grey. The shaft had a slightly smaller percentage of poorly calcined bone, 26%. Of this, 15% were light grey, 9% mid-grey and 2% dark grey. The distal showed significantly less poor calcination. Only 12% of the fragments were affected by poor calcination, of this 9% were light grey and 3% mid-grey.

In the radius, the shaft was the part with the highest percentage of poorly calcined fragments with 32 % of the fragments affected by poor calcination. Of this, 23% were light grey, 4% were mid-grey and 5% were dark grey. In the distal end, 22% of the fragments were affected by poor calcination. Of this, 18% were light grey and 4% were mid-grey. The proximal end was least affected by poor calcination. Only 12% of the fragments showed poor calcination. 10% of the fragments were light grey and 2% were mid-grey.

Sandwich effect is the term used for an effect in which a layer of poorly calcined bone is sandwiched between areas of fully calcined bone. Examples of this would be skull fragments in which the diploe was poorly calcined, or longbone fragments where the surface of the bone and the inside are well calcined and a layer of the cortical bone is poorly calcined. As this was a commonly occurring phenomenon, it was included in the analysis.

Sandwich effect was most common in skull vault fragments, especially non-specified skull vault fragments and fragments of the occipital bone. Other fragments with high levels of sandwich effect were fragments of the mandible and longbone fragments, especially the shaft fragments of longbones. In total, there were over 1000 fragments with sandwich effect in the skull, more than on the other three body areas combined. Both upper and lower limb fragments had similar amounts of fragments with sandwich effect, around 100 each. Sandwich effect was very rare on the axial skeleton.

	Pyre goods	Unworked bone	Worked bone	Flint
Male?	8	4	3	3
Female?	4	3	1	1
Adult	22	13	8	5
Non-adult	6	6	1	0
Deposits	17	13	4	4
MNI=1	10	9	2	3
MNI=2	6	4	2	1
MNI=3	1	1	0	0

Table 5.17: Pyre goods broken down by sex, age, deposit and MNI per deposit. A single individual or deposit can be associated with multiple pyre goods types.

5.8 Pyre goods

As seen in Table 5.8, a total of 17 deposits, 22.7% of the whole material, contained pyre goods. 16 (21.3%) of these contained animal bone, either worked or unworked. Only material encountered during analysis was included. Any material mentioned in relevant publications, but which was not present amongst the bones analysed, was not recorded.

A more detailed overview of the pyre goods can be seen in Table 5.8. In most cases, the animal bone was not identified to species level, but note was taken of the relative size of the animal. A few deposits were studied by zooarchaeologist Sheena Fraser, using comparative material from the National Museums of Scotland. Non-human bone fragments were identified in 13 of the 75 deposits. One of the deposits, from Brackmont Mill, contained bone fragments from three types of animal (horse/cow, sheep/goat and dog/dog-sized animal). A deposit from Bridge of Banff contained fragments of an unknown dog-sized animal. These fragments could not be identified to species level, but it was suggested that they might possibly be seal bones. Examples of identified pyre goods can be seen in Figure 5.9.

There were nine cases of worked bone. Six of these came from two deposits. Two fragments of bone toggles (it is unclear if they are both from the same artefact) from one of the Brackmont Mill urns, and four different worked bone artefacts from Cairnpapple (bone pin, bone plaque, bone toggle and an unknown object). The remaining worked bone artefacts were not possible to identify. A deposit from Glenluce contained a fragment of longbone with a drilled groove.

Site name	Deposit name	Material	Description
Brackmont Mill	EQ 736-739	Worked bone	Bone toggle, fragment, 0.5g.
Brackmont Mill	EQ 736-739	Worked bone	Fragment, bone toggle, 1 g
Brackmont Mill	Unknown deposit	Animal bone	Horse or cow, 15 g in total
Brackmont Mill	Unknown deposit	Animal bone	Sheep or goat
Brackmont Mill	Unknown deposit	Animal bone	Dog or dog-sized
Bridge of Banff	EA 11	Animal bone	Metacarpals/tarsals, ?dog-sized, ?seal 14 g
Cairnpapple	EP 178	Worked bone	Bone pin, several frags, head is perforated
Cairnpapple	EP 178	Worked bone	Bone plaque?
Cairnpapple	EP 178	Worked bone	Bone toggle?
Cairnpapple	EP 178	Worked bone?	Worked bone?
Carnousie	EA 47	Animal bone	Sheep sized, juvenile, phalanges, metacarpals/tarsals, 14 g
Culbin Sands	EA 122	Animal bone	Largish animal longbone and skull, 12 g
Culbin Sands	Unregistered	Animal bone	Longbone frag, 2 g, poss. cutmarks
Easter Gellybank	EA 111	Animal bone	Small pieces of bone, 1 g
Fetteresso	Unregistered	Animal bone	Dog/pig? 14 g
Fetteresso	Unregistered	Flint	Burnt flint, 12 g
Gilchorn	EQ 222	Animal bone	Mostly longbone frags, 31 g
Glenluce	BHA 154	Animal bone	Thin, suggested rib, 1 g
Glenluce	BHA 154	Animal bone	Tooth? Not fully formed root
Glenluce	BHA 154	Worked bone	Longbone w. Drilled groove, could be human?
Hill of Culsh	EQ 264	Animal bone	Longbone frag, 2 g
Howford Farm	Unregistered 1	Animal bone	Longbone, 1g
Kingskettle	EQ 346 (2 urns)	Flint	Small chunk, 2 g
Kingskettle	EQ 346 (2 urns)	Animal bone	Antler, 2 grooved frags, 3 flat frags 22 g
Kingskettle	EQ 346 (2 urns)	Animal bone	Longbone frag, possibly worked? 3 g
Kirkpark, Inveresk	EA 145	Flint	Piece, 17 g, looks burnt?
Longniddry	EQ 505 or EQ 502	Flint	Burnt, 5 g
Tuack	EP 5	Worked bone	Bone toggle, long bone shaft w rows of drilled holes
Tuack	EP 5	Animal bone	Small frag of longbone
Udny	EA 121	Worked bone	Carpal/tarsal with drilled hole in head? 1 g

Table 5.18: Pyre goods by deposit.

Figure 5.9: Pyre goods. Fragment of bone plaque and bone pin, Cairnpapple EP 178. Piece of flint, Kirkpark EA 145.

Body element	Turquoise staining	Total frags	% occurrence
Axial	50	303	16.5
Lower limb	103	562	18.3
Skull	165	1195	13.8
Upper limb	77	456	16.9
Total	395	2516	15.7

Table 5.19: Turqouise staining on fragments grouped by body element.

It is possible that the bone is a human juvenile bone. A deposit from Tuack contained a fragment of what seems to be some sort of bone toggle or bone bead. Finally, a deposit from Udny contained an animal carpal or tarsal with a drilled hole in the head. Flint was found in four deposits.

5.9 Charcoal

Out of the 75 deposits, only 17 contained charcoal. The total weight of charcoal was 33g. It cannot be ruled out that there might have been more charcoal present, but that it was not collected by the excavators. However, the fact that even deposits containing soil and stones contained little charcoal would suggest that the small quantities of charcoal reflect the mortuary ritual, and not excavation practices.

5.10 Turquoise staining

As seen in Table 5.10, blue/turquoise staining was found in 55 of the 75 deposits, although the levels of staining vary significantly. It was quite faint in some deposits (which made it difficult to photograph) whereas it was very bright in others. These specks are believed to be from copper alloys, and the limited amount of analysis that has been carried out on them supports this.

The stains were relatively equally distributed throughout the body. However, some differences were noted. The lower limb had the highest percentage of stained fragments, 18.3%, whereas the skull had the lowest percentage of stained fragments, 13.8%. The axial skeleton and the upper limb fell in between, with 16.5% and 16.9% respectively.

Chapter 6

Discussion

6.1 Temporal and geographical variation

Most of the burials analysed date to the Earlier Bronze Age. Only one of the urns, Old Keig EP 48, Aberdeenshire, is radiocarbon dated to the Later Bronze Age. A further three bucket urns, Rayne EP 23, as well as Bognie EA 102 and EA 103, all from Aberdeenshire, have not been radiocarbon dated, and might belong to the Later Bronze Age. This could also be the case for some of the 11 burials from urns that could not be classified and which are currently only dated as Bronze Age. Knowledge about Later Bronze Age urned burials is very poor. Although certain types of pyre goods, such as bone toggles and faience beads are only found in Earlier Bronze Age burials (Sheridan, 2007a), it is possible that the way in which the bodies were handled was similar. Nevertheless, the material analysed for this thesis is clearly more representative for reconstructing the mortuary ritual of the Earlier Bronze Age than the Later.

Regional variation is likely to have existed, even within the Earlier Bronze Age. Burgess (1980, 296-97) argued that the wide variety of mortuary rituals that existed in Bronze Age Britain were not due to different people or cultures, as previously thought, but rather a question of different traditions co-existing. In his opinion, the variation was due to the fact that innovations in mortuary ritual were adopted partially in a pick-and-mix fashion, and were adapted to suit the needs and customs of the individual, the family and the community. In his work on collared urns, Longworth (1984, 47) suggested that although major trends existed, mortuary ritual was so varied that any particular tradition within the wider context would have been extremely localised, perhaps unique to a single family unit. A similar theory is suggested by Wysocki and Whittle (2000, 599), who, in their study of Early Neolithic mortuary ritual in the Black Mountains, Wales, suggested that although there was an overarching consensus in ideas, there was no uniformity in actual customs. They argued that the situation might indicated semi-autonomous communities, which balanced maintaining an own social identity and taking part in interactions with other communities. The wealth of options probably seems more extensive than what it actually was - some of the variation might be due to small-scale temporal and/or geographical patterns. However, radiocarbon dating of bones have confirmed that urned and un-urned burials found on the same site can be contemporary (e.g. Johnson and Cameron, 2013). Furthermore, it is possible that not everyone received an archaeologically visible form of burial. What made the mourners chose one option over the other is not known.

The transmission of ideas would have been radically different in prehistory, when the lack of written communication would have made transmission dependent on the movement of people. There is no doubt that there were very widespread traditions of mortuary ritual as far back as the Upper Palaeolithic (Pettitt, 2006), with later examples including the Megalithic phenomenon (Bradley, 1998), Beaker type burials (Sheridan, 2008b), and perhaps the spread of cremation during the Bronze Age (Harding, 2000, 72-75). However, traditions such as the Beaker burials, which were very similar over a large area, would still have shown some regional variation (Sheridan, 2008b, 60). The Bronze Age, even the Earlier Bronze Age, represents a significant period of time, during which ideas are unlikely to have been static and unchanging. What this means for the interpretation of the mortuary rituals, is that instead of giving a detailed picture of the rituals in one place and at one time, this thesis aims to give a broad outline of the mortuary ritual over a larger area, and spanning several hundred years.

6.2 The sequence of the mortuary ritual

The following section comprises a discussion of what happened before, during and after cremation, based on specific questions that could be answered using the results of the osteological analysis.

6.2.1 Before cremation

Who was cremated

As discussed in the literature review, determining sex on cremated remains is difficult. It is largely dependent on the survival of sexually dimorphic elements in the skull and pelvis, which are not always found. This was reflected in the Bronze Age chapter, which indicated that there are relatively few sexed individuals found in Bronze Age urns. The same applies for the burials analysed for this thesis. Out of the 103 individuals identified, only 38 could be tentatively sexed; roughly half of the adults as well as two adolescents. It must be stressed that the determinations of these individuals is not without uncertainty, as in many cases it relied heavily on elements of the skull, particularly the supraorbital margins, which are not as exact as elements of the pelvis. Of the 38 sexed individuals, 22 are ?males, and 16 ?females. Obviously, the sample is much too small to draw general conclusions, but the fact that there seems to be more males even in previously excavated urns is noteworthy.

In contrast, a secondary study by Brück (2009), which used all types of cremation burials from Bronze Age Scotland, in other words not only urned cremation burials, suggested that females were overrepresented. The findings were later criticised (Hall, 2009). A study of previously analysed Late Bronze Age cremations from Denmark, Southern Sweden and Northern Germany found a higher percentage of males than females, but it was suggested that it was impossible to know whether this was linked to mortuary practices or problems with sexing cremated remains (Hornstrup, 1999). Caution is needed when addressing issues of sex and gender, due to the unreliable nature of sex determination on cremated remains. Nevertheless, the question of whether males or females were deemed as more suitable for urned cremation burial is interesting and worthy of further research.

The determination of age was more successful, as the age categories were wide, and because a larger number of skeletal elements can be used to determine age rather than sex. All individuals in the analysed urns could be placed in one of the three age categories. As expected, adults (71) were more numerous than non-adults (32), of which there were 24 children/adolescents and eight infants/foetuses. The number of non-adults was higher than expected, and it is possible that some of the older adolescents were considered adults in Bronze Age societies.

Eight of the non-adults, two foetuses/infants and six children/adolescents were placed in urns with an MNI of 1, in which there can be little question that they were the main focus of the mortuary ritual. There is evidence of some very young individuals receiving urned burial on their own, namely the infants from Carnousie, Aberdeenshire and Longcroft, Scottish Borders. What made these infants different from the six infants buried in urns with an MNI of >1 is unknown. Outside urned cremation burials, cremated infant remains seem to be more common on some sites than others. The high number of perinatals among the immature individuals at a cairn at Sketewan, Perth and Kinross, was linked to the fact that mortality is higher for the very young compared to older children (McSweeney, 1997b, 313), but this does not explain why they would be less common on other sites.

The results suggests that all ages and both sexes were eligible for urned burial. Whether males or females were more likely to be buried in urns cannot be determined based on the data available.

Were bodies cremated as complete bodies or as dry bones?

How bodies were prepared before cremation can tell us something about the length of the interval between death and cremation, as well as reflect ideas about the human body held by the mourners. Fracture patterns and warping, which have often been used as indicators, are unsatisfactory for use to determine whether cremated remains resulted from the burning of dry bones or of a fresh body. An important question was thus whether there were other indicators which could be used. A method explored for this thesis was the interpretation of calcination patterns, as aspects of the anatomy would also have influenced the burning. It is worth keeping in mind that the patterns of calcination are only based on identified fragments, which can constitute less than half the weight of the remains. For this reason, there is always an element of uncertainty about the interpretation.

The patterns of calcination in the skull match the pattern observed in crematorium cremation (e.g. Günther and Schmidt, 1953; McKinley, 1994c; Bohnert et al., 1998). The bones of the face, exposed early in the cremation process due to the thin covering of soft tissue, showed a higher degree of calcination than the skull vault. Calcination became increasingly poor towards the back of the skull and was poorest at the occipital, coinciding with the increasing thickness of the bone and amount of shielding soft tissue. The occipital bone is both the thickest of the skull bones and associated with strong muscle attachments that help to keep the head upright, and it tends to be the last to burn in a crematorium cremation (McKinley, 1994c, 75).

The axial skeleton was well calcined compared to other parts of the body, and again, anatomical factors seem to be the main explanation. The bones in this category consist of relatively thin, cancellous bone, and most of them are situated close to the surface of the skin. The relatively poor calcination seen in the cervical vertebrae, compared to the rest of the spinal column, was likely due to the strong muscles present in the neck. The thoracic vertebrae, lumbar vertebrae and sacrum are more exposed, which might explain the higher degree of calcination. The degree of calcination did not differ significantly between the bodies of the vertebrae and the neural arches. The thoracic vertebrae are the most calcined part of the spinal column. The thorax, including the ribs and sternum, showed an even higher degree of calcination, which is expected as it is exposed early on in the burning process (Bohnert et al., 1998, 13-14).

In the upper limb, the bones in the hand were well calcined. The hands are not associated with large amounts of shielding soft tissue, and would be exposed early on in the cremation process (Bohnert et al., 1998, 13-14). Views differ quite radically on the topic of whether this lack of soft tissue contributes to or hinders calcination. Some practitioners argue that the early exposure of hand- and foot bones means that they will be completely destroyed in the fire, unless shielded by lying over the chest of the corpse or burnt at a temperature of under 700°C(Holck, 2008, 111-112). Others argue that the lack of fat in hands and feet should result in these bones being poorly burnt, since there is nothing to keep them burning (Mays, 1998, 220). Nevertheless, the hand phalanges of the analysed material were slightly better calcined than the rest of the hand, in which the bones are less exposed. Similarly, the scapula is a very thin bone, as well as relatively exposed, and it was also well calcined.

There is little to suggest that parts associated with more fat burned better, although the upper limb is a possible example. The relatively poor calcination in the ulna and radius could perhaps be explained by the amount of muscle and connective tissue, including the interosseous membrane between these bones. They were less well calcined than the humerus, which is a more massive bone, and which is less exposed than the bones of the lower arm. Could this be a case where fat has influenced the burning, causing the humerus to be better calcined than the bones of the lower arm? However, this would perhaps make more sense in 21st century humans, who are more prone to obesity, than Bronze Age individuals. The occurrence of a pugilistic posture, if this occurred at all, could be another possible explanation. In a model suggested by Symes et al. (2008, fig. 2.7) for burning patterns in a corpse in which the pugilistic pose has occurred, the lateral aspect of the humerus will be exposed to the fire early on, whereas the lower arm, and especially the ulna, will be protected. It has been suggested that the arms may move outwards during the burning process, causing the lower arm to be further away from the centre of the heat (McKinley, 1994c, 83). This seems counterintuitive, as there is little evidence in any of the studies of the cremation process (e.g. Günther and Schmidt, 1953; McKinley, 1994c; Bohnert et al., 1998) to suggest that the body moves in this fashion. Interestingly, adjacent areas of different bones, such as the distal humerus and proximal radius, showed similar levels of calcination.

The high level of poor calcination in the clavicle was unexpected, as it is a relatively thin bone as well as being subcutaneous and therefore expected to be exposed early on in the cremation process. A possible explanation is that there are few clavicle fragments (30) compared to other elements of the body. The results are therefore more sensitive to outliers in the data.

In the lower limb, the femur was poorly calcined, perhaps due to the thickness of the bone and of the surrounding muscles. The fact that the tibia was more calcined than the fibula or the femur might be explained by the fact that it lies so close to the surface of the skin and that it is exposed early on in the cremation process (Symes et al., 2008, fig. 2.7). The fibula, on the other hand, is more embedded in soft tissue. The bones of the feet were more calcined, especially the phalanges, and it is likely that this is a result of being exposed early on, due to the scanty covering of soft tissues. It is difficult to say why the patella was so poorly calcined, as it is exposed early on in the burning process. There are few fragments, which again make it sensitive to outliers. It is also possible that it might have dislodged and been buried in the ash at the bottom of the pyre.

Overall, the results suggested that anatomy had a large influence on the calcination patterns. With a few exceptions, the most calcined bones and groups of bones were those which are thin or delicate, especially those poorly covered by soft tissues, which are exposed early on in the cremation process. This includes the bones of the hands and feet, the scapula, the bones of the face, and the thorax. These groups of bones contained no black bones, and most of the poor calcination was light grey. The bones or groups of bones showing the highest degree of poor calcination are, generally, those which are thicker and more massive, as well as those deeply embedded in soft tissue. This includes the femur and the occipital as well as thinner, but more embedded bones such as the fibula and ulna. Thicker bones, such as the femur and the occipital, showed more dark grey, as well as sandwich pattern, in which the outside of the bone is calcined, but not the inside. Sandwich effect as a whole seemed to be strongly linked to the thickness of bones, being more common in skull vault bones and long bone shafts.

The high level of poor calcination on exposed elements such as the clavicle and the patella were the most unexpected results. However, the low number of fragments of each element might explain the anomalies. Another unexpected finding was that the humerus was more calcined than the bones of the lower arm, despite being a more massive bone. This might be due to higher levels of fat in the upper arm compared to the lower arm, as well as the presence of the interosseous membrane in the lower arm.

From this evidence, it seems likely that the body went on to the pyre fleshed, and not as dry bones. The complete lack of cutmarks might also suggest that the bodies were not dismembered, as was the case in some Iron Age Norwegian cremation burials (Holck, 2008, 126-127). Cremated remains from bodies cremated as dry bones would not have been affected by the presence of soft tissue, and would not be expected to show much variation in calcination (Buikstra and Swegle, 1989; McKinley, 1994c).

Position on the pyre

Several reports on Scottish cremated human remains include discussions on the position of the body on the pyre, based on calcination patterns (e.g. Smith, 1995; Mercer and Midgley, 1997; Roberts, 1998b,a; Powell, 2001). In all but one, it is suggested that poor calcination at the back of the skull and sometimes in the lower limb indicates that the body was cremated lying on its back. Only the remains from Findhorn (Powell, 2001) were interpreted as suggesting that the body had been lying on its side, due to one side being more completely calcined. There is also evidence of at least one pyre site with the remains left in situ, in which the outline of the cremated remains suggest that the body was crouched (Kilbride-Jones, 1936).

The results of the osteological analysis suggests that the back of the skull and the cervical vertebrae were relatively poorly calcined compared to the rest of the spinal column. This pattern has traditionally been used to infer a position in which the body is lying supine, due to the contact points with the underlying material helping to shield these parts from the effects of the fire. However, as outlined above, the anatomy of the region would also contribute towards poor calcination. Other suggested indicators of a supine position include poorly calcined neural arches or dorsal portions of vertebrae, but this was not found in this study. The scapula, another bone which has been suggested to be poorly burnt in bodies cremated whilst lying supine, was well calcined. Some earlier work on Scottish cremation burials have found poorly calcined fragments in the hands and feet, and suggested that this might be due to pyres which were too small. Similarly, McKinley (1994c) found poorly calcined fragments of the lower legs in the remains from Spong Hill. The material studied for this thesis was generally very well calcined in the hands and feet, although the lower legs were relatively poorly calcined. Ethnographically, a supine position seems to be the most common (Wahl and Wahl, 1983), but it is difficult to deduce such a position from the available data. It is possible that the relatively well-calcined hand and foot bones indicate that pyres were large enough for these bones to be well burnt.

The conflicting information makes it difficult to reconstruct the position of the body on the pyre. The problem is compounded by the lack of research addressing the issue. Some limited observations by Wells (1960) in a crematorium suggested that the calcination patterns changed if the body was burned prone rather than supine. However, most discussions of the topic tend to be based on informed speculation by authors studying large assemblages of cremated remains, and with experience of having observed crematorium cremations. The most cited ones include the work of McKinley (1994c) on the Anglo-Saxon cemetery of Spong Hill; the work of Holck (2008) on prehistoric Danish and Norwegian cremation burials and a discussion by Mays (1998) based on his work on Anglo-Saxon remains. However, none of the studies using experimental pyre cremations of animals have addressed the issue of calcination patterns. Due to differences in anatomy, such as the different ratios of soft tissue and the length of the limbs, it is also questionable how useful it would be. For these reasons, it was not possible to reconstruct the position of the body on the pyre.

Pyre goods

Pyre goods offer some insight into other aspects of the preparation of the bodies, especially how they were dressed. Bone toggles and/or pins were found in three graves. At Brackmont Mill, an urn (EQ 736-739) containing two adult males, contained fragments of one or possibly two bone toggles. Cairnpapple EP 178 contained the remains of an adult male and a second adult individual, possibly a stray bone, as well as fragments of a bone pin, a possible bone plaque, a possible bone toggle and fragments of a fourth, unidentified, object of worked bone. Tuack EP 5 contained the remains of a child/adolescent as well as fragments of a bone toggle. As mentioned previously, bone toggles are uniquely associated with cremation burials, and are thought to have been associated with shrouds or other sorts of clothing. As they are not found with inhumation burials or in other context, it is possible that they relate specifically to the cremation ritual.

Other pieces of worked bone are more enigmatic. Udny EA 121, containing the remains of an adult male, contained a carpal or tarsal with a drilled hole through the head. The bone was not identified to species level. Glenluce BHA 154, which contained the remains of an adult female, contained a bone fragment with a drilled groove. The bone did not have a typical animal appearance, and it could not be ruled out that it was a longbone of a child. Although the carpal/tarsal could have been part of personal ornamentation, the significance of the possible human bone proves elusive. Finds from a further urn may possibly be associated with how the body was presented. Carnousie EA 47 contained the remains of an infant, as well as phalanges and metacarpals or metatarsals of a juvenile sheep/goat. A similar find of an infant with juvenile sheep/goat phalanges from the Late Bronze Age cemetery at Gualöv, Sweden, was interpreted as the infant being cremated wrapped in, or lying on the skin of a lamb (Arcini, 2007, 183). It is possible that this is what happened at Carnousie. It is interesting to note that there was such a high degree of poor calcination in this deposit, as 95% of the remains showed evidence of poor calcination. If the body was wrapped in the skin of a lamb, the poor calcination can be explained by the wool acting as insulation against the effects of the pyre. It is also possible that the poor calcination is due to the aforementioned low level of body fat in infants (Holck, 2008, 118). Nevertheless, the care taken in the presentation of the dead bodies is a further indication that the dead were cremated complete.

Another category of pyre goods were pieces or flakes of flint. It is possible that flint flakes may have been used in the mortuary ritual. Cutting tools found with cremation burials from Iron Age Norway have been associated with the cutmarks and unusual calcination patterns seen on some of these cremation burials, suggesting that the tools had been used to cut up the bodies before cremation took place (Oestigaard, 2000, 48). This seems not to have been the case with Scottish urned cremation burials, due to the lack of cutmarks or anything else to suggest the bodies were dismembered at the time of cremation. However, cutting tools and flakes can also be associated with other aspects of burials, such as food preparation. As the flints found were not analysed by an expert, it is not possible to explain their function. It has been suggested that the occurrence of flint associated with ritual burning, as well as cremation burial, could be highly symbolic. This is because flint resembles bone, and it changes in a way similar to bone when it is exposed to fire. Indeed, at a quick glance, and without touching the pieces, it can be quite easy to confuse burnt flint flakes with burnt bone. The knapping of lithic materials occurs widely in funerary contexts. It is easy to label it as 'ritual', without further discussion, due to its proximity to burials (Larsson, 1989, 216-218). One example is the act of smashing quartz on Bronze Age Scottish cairns, which has been interpreted as a commemorative act (Warren and Neighbour, 2004, 93).

The green/turquoise stains, which have been shown to contain higher levels of copper than areas without stains, indicate the presence of copper or copper alloy objects being present. Whether this was on the pyre or whether it represents objects placed with the urn is not clear. Since most of the urns are from older excavations, when soils were not as acid as today, it is perhaps not unreasonable to assume that they represent objects placed on the pyre, which might not always have made it to the urn. Green/turquoise staining was much more common than expected, with a majority of the burials, 73%, showing some evidence of staining. This result was much higher than in the author's MSc thesis, in which only 8% of the burials were reported to have contained these stains (Medina-Pettersson, 2008, 49). The discrepancy between these results is likely to be caused by several factors. The MSc study was a review of previously published studies, using the published reports, which might not have contained all the details of the original osteological reports. Stains might also be underreported, as faint ones are easy to miss, and because their significance might not be obvious to practitioners not used to working with cremated remains. Nevertheless, it is possible that bronze objects are more commonly associated with urned cremation burials than with other types of cremation burial.

If this is the case, it is worth reflecting on the meaning of bronze. Was it a status marker, or was there some other meaning attached to it? No bronze was found during the osteological analysis, but it is known that bronze objects were found with a few of the urns, and that it is stored separately. In general, bronze objects are rare in cremation burials. If they were included on the pyre, it is possible that they have been largely destroyed by the fire, and not picked up from the pyre site. Another theory is that bronze was recycled after cremation (McKinley, 1994a). It is also possible that small quantities of bronze found in the urn would have been completely destroyed by taphonomic factors since being buried. This would certainly hold true for modern excavations, but in the case of older excavations, before the soils becoming increasingly acidic, metal preservation is expected to have been better (Ullen et al., 2004).

Overall, pyre goods were about as frequent as expected, with 18 out of 75 graves (24%) containing any type of pyre goods, and 13 (17%) contained unworked animal bone, the most common type of pyre goods. In comparison, 23 out of 86 deposits (27%) used in the author's MSc dissertation contained pyre goods. Out of these, 13 (15%) contained unworked animal bones (Medina-Pettersson, 2008, 53-54). In a study of c. 130 British Bronze Age cremation burials, (McKinley, 1997, 132) c. 16% contained fragments of animal bones. The material analysed for this thesis differs from the other samples in that only urned cremation burials were included, the others included other types of cremation deposits, such as un-urned deposits, cist burials as well as pyre debris and pyre sites. Furthermore, pyre goods may have been removed to be stored elsewhere at the time of excavation. Apart from the possible higher incidence of copper alloy staining, there is nothing obvious to suggest that the pyres of individuals who were later buried in urns were any different from those of individuals who were buried un-urned or in cists.

Other pyre goods can give an insight into other aspects of the pyre, such as its size. Most of the burials containing pyre goods contained small quantities of animal bone, insufficient for representing complete animal carcasses. It is unclear whether this is due to not all bones being collected, or because only parts, such as meat joints, were placed on the pyre. However, possible cutmarks were only found on one fragment, on an unidentified longbone fragment from the unregistered burial from Culbin Sands. This relative lack of cutmarks might indicate that it was not joints which went on the pyre, but complete carcasses. In some cases, where urns have been matched with their respective pyre site, such as in southern Sweden, it was shown that most of the animal bones were left on the pyre (Arcini, 2005). This could be the case with the burials analysed for this thesis, although in the absence of pyre sites, it is impossible to tell.

Although species was not determined for many of the faunal remains found in the burials analysed, a variety of species were encountered, including sheep/goat, but also cattle or horse, deer (represented by antler), as well as dog-sized animals, possible pig bone and bones from a species which could not be identified, despite extensive comparisons. This indicates that both wild and domesticated animals were acceptable as pyre goods. The most impressive assemblage came from the unknown urn at Brackmont Mill, which contained the remains of an adult, as well as quantities of bone fragments from at least three species, horse/cow, sheep/goat and dog/dog-sized animal. Had all these animals been placed complete on the pyre, as was the case for early historic or medieval cremation burials, it would have implied a large pyre. Complete carcasses would also imply a difference to inhumation burials. In some cases, it cannot be ruled out that only very specific parts of animals may have been included. Had all the animal remains been analysed by a specialist, it would have been possible to tell more about what sort of animals were included. The limited analysis carried out for this research suggests that both wild and domesticated animals were included, with domesticated ones being more common.

The pyre goods identified suggests that at the very least some of the bodies went on the pyre dressed, and that some pyres could be of a significant size.

6.2.2 During cremation

Efficiency of cremation

As seen in earlier chapters, there seems to be a consensus on the fact that Scottish Bronze Age cremated remains are well calcined. The results of the research for this thesis supports this view, and confirms that calcination was efficient. Only around a quarter of the identified fragments showed any evidence of poor calcination. Most fragments were classified as white, indicating that their main colour was white or very pale grey nuances. Only c. 50 were classified as black, being black or dark grey, and none was classified as tan. Even in the areas that showed some degree of calcination, light grey, rather than darker nuances, was the most common. Levels of poor calcination varied based on age and sex, with adults being more completely calcined than children/adolescents, which in turn showed a higher degree of calcination than foetuses/infants. Furthermore, males were more completely calcined than females.

These findings were based on the subset of burials with an MNI of 1, which makes up about half of the original one. The results should therefore be understood as speculative. It has been suggested that infants and children burn less well than adults, especially infants, due to their very low proportion of body fat (Holck, 2008, 118). Why females would burn less well than men is not clear, as the higher proportion of fat and lower levels of skeletal muscle should make burning easier. It might indicate some variation in the mortuary ritual based on gender, such as women receiving smaller/poorer quality pyres, but it is difficult to generalise from the small sample.

Cremated remains from other areas of the world, such as those from Late Bronze Age Slovenia, show that high level of calcination were not always aimed for (Thomas, 2011). Cremated remains from Roman Britain show variation with remains from the city being poorer calcined. This was suggested to be because cremation in the cities was performed by professional cremators, for whom complete calcination was not essential (McKinley, 2008). Poorly cremated remains from Scottish Bronze Age urns have been reported, such as an urn from Idvies, Angus (Callander, 1924), and an urn from New Luce, Dumfries and Galloway (Curle and Bryce, 1916). The latter, which contained two adults, was said to have been more poorly cremated than what was usual for Bronze Age cremation burials. The vertebrae were particularly poorly cremated, being described as only partially burnt (Curle and Bryce, 1916, 20). None of the cremation burials studied for this thesis stood out as very poorly cremated, to the extent that most of the bones were black. However, some contained more poorly cremated remains than others, such as the remains of an infant from Carnousie, in which 95% of the identified fragments showed some evidence of poor calcination.

The overall results point to a situation in which the technical know-how of efficient cremation existed, where there was enough fuel to fire efficient pyres, and where it seems to have been important to achieve a high degree of calcination. As mentioned above, the fact that the bones of the hands and feet show less poor calcination than expected, might possibly indicate that pyres were large enough to avoid this. Some burials are less calcined than other, but as all of these were outdoor cremations, it is only to be expected (McKinley, 2008; Holck, 2008). An important question is whether there were professional cremators or ritual specialists of some sort in charge of the cremations. This might have been someone with a larger knowledge than others about cremation. It has been suggested that bronze-workers might have been cremators, due to their mastery of the special skill of metalworking (Goldhahn, 2007). Whether such a case can be argued for the Scottish Bronze is not a question that can be adequately answered based on the research carried out for this thesis, but the frequent inclusion of bronze on the pyre is an interesting link, and the question is worthy of further research.

Tending and raking of the pyre

Levels of fragmentation are dependent on several causes, including taphonomic processes in the earth, as well as practices such as crushing (which will be discussed below) and the raking of the pyre. In a study of 297 Romano-British cremation burials from St. Stephens, St. Albans, McKinley (1994b, 340) found that the percentage of material in the >10 mm sieve was 55% overall, rising to 87% in undisturbed lidded urn burials, showing the significant influence of taphonomic processes. For the category of undisturbed burials, (urned and unurned), McKinley (1994b, 340) found that the percentage of material in the >10 mm sieve was 59%, the average longest cranial fragment was 40.9 mm and the average longest longbone fragment was 64.8 mm. The percentage of material in the >10 mm sieve in the material analysed for this thesis was 64%. This number is higher than the ones from the combined urned and unurned undisturbed deposits from St. Stephens. However, they are lower than the ones from the exceptionally well-preserved undisturbed lidded urns from St. Stephens.

The comparison suggests that the deposits used for this study are in a fairly good condition. Some of the urns analysed for this thesis contained remains which showed a relatively high degree of fragmentation. In general, the remains were well-preserved, which indicates a conscious effort on behalf of the mourners, as cremated remains need to be handled with care to minimise fragmentation. In the cases where the urns are known to have been complete at the time of burial, it must have served to protect the remains from the surrounding soil.

On sites where both urned and un-urned remains from roughly the same period have been excavated, such as at Ratho or Skilmafilly, the urned remains tend to be heavier (Smith, 1995; Johnson and Cameron, 2013). This is likely to reflect taphnomic processes in the soil rather than the actions of the mourners. The conditions of the urns at the time of excavation was not known in the majority of cases for the burials analysed for this study, and so this factor cannot be properly analysed.

The relatively low fragmentation suggests that there was no significant amount of raking of the pyre.

6.2.3 After cremation

Collection of remains and pyre goods from the pyre

The data from deposits with MNI=1 show that weights of cremation deposits vary with age and sex. Deposits tend to weigh more if the individual is an adult, with lower weights for children/adolescents and even less for infants/foetuses. The lower weights for non-adults coincides with them having smaller bodies and less mineralised bones compared to adults (Holck, 2008, 118-119). As for sex, it is suggested that MNI=1 deposits containing males weigh more than those containing females or those of unknown sex. Again, this coincides with data from modern crematoria, which suggests that remains of males tend to be heavier than those of females (e.g. McKinley, 1993). However, the weight of cremation deposits are not only the result of the cremation process, but also human agency. Therefore, it is not unknown for female burials to be heavier than male ones. At the Early Bronze Age cremation cemetery of Lustrupholm, Denmark, there was a marked difference in size between the male and female cremation deposits, with the male ones being smaller in both weight and volume (Feveile and Bennike, 2002). This was interpreted to mean that the remains of females were more carefully collected than those of males. Similarly, in discussing his sample of Danish and Norwegian cremation burials, Holck (2008, 105) suggested that the remains of women were more carefully collected. He argued that if they had not been, they would have weighed significantly less than the male ones. In the case of the cremation burials analysed for this thesis, the low number of sexed individuals makes it difficult to draw any firm conclusions.

The weight of the deposits is below the expected weight of a single cremated individual, which typically weigh c. 1000-2500 g (McKinley, 1993). The relatively low weights could be entirely due to taphonomic processes in the soil. However, the fact that the burials were placed in urns, many of which seem to have been complete at the time of excavation, suggests the additional influence of cultural factors, namely that not all of the cremated remains from the pyre were buried in the urn. This could indicate that not all of the remains were collected from the pyre site, or that only a part of the collected remains were buried. There is no way to answer this question. The frequent burial of redeposited pyre debris in the same pit as the urn, or in separate pits, indicates that even material that did not go into the urn was important, or perhaps polluting. It has been suggested that part of the remains may have been distributed among the mourners after cremation (McKinley, 1997; Brück, 2004).

Selection of remains to be buried

In most burials, all of the four main parts of the skeleton (skull, axial skeleton, upper and lower limb) were present among the identified fragments. Cases where one of the parts was missing tended to be the smaller deposits, and could be due to the missing part going unidentified. Skull fragments were less likely to be missing, which might be because these fragments are the easiest to identify. This could also explain why the skull fragments often weighed proportionally more than expected, compared to the other body parts. There is no reason to suppose that one part of the body was more important than the others.

The small quantity of animal remains and other pyre goods could indicate that it was mainly the human body which was important. It seems likely that the remains were carefully picked from the pyre, as only very small quantities of charcoal were found in the urns. This does not mean that remains were washed, as cremated remains are clean from the pyre. It does indicate that remains were not simply raked together, but that fragments were picked individually from the pyre. This would have been significantly easier if the pyre had not been stoked, but allowed to burn down naturally. This would have made the remains lie in an anatomical order on the pyre site, as seen on the pyre site at Loanhead of Daviot (Kilbride-Jones, 1936), and would have made it easy to separate the human remains from any possible animal remains.

In many cases it does not seem to have been important to include pyre goods in the urn. The pyre goods found in the urn represent the absolute minimum of what went on the pyre. It is possible that pyre goods had an importance on the pyre, and once they had been through it, there was no need for them to go with the body in the urn.

Crushing of cremated remains

As discussed above, the degree of fragmentation was low, and there is nothing to suggest that remains were additionally crushed before being placed in the urn. Urns were generally large, meaning that there would have been no need to crush the remains to fit them inside the urn. As not all of the remains were placed in the urn, there would have been even less need to crush the remains. Crushing of the remains indicates that there is a strong will to destroy the body (e.g. Rakita and Buikstra, 2005a). As mentioned above, there are urns with somewhat smaller fragment, but it is likely that this is due to the urn having broken since deposition.

Mixing of individuals

The number of deposits with an MNI of >1 was higher than expected, with 20 deposits containing a at least two individuals and four deposits at least three individuals, giving a total of 32% of deposits containing an MNI of >1. In comparison, McKinley (1997, 130) states that in a sample of c. 4000 cremation burials from varying periods, only c. 5% contained more than one individual. In 86 Scottish Bronze Age cremation deposits with a known MNI reviewed in the author's MSc dissertation, 20% contained more than one individual (Medina-Pettersson, 2008, 43). The high proportion of burials with an MNI of >1 enforces the view of Bronze Age burials as similar to Neolithic collective ones (Brück, 2004, 180).

It is very difficult to prove beyond doubt that remains in urns with an MNI of more than one represent individuals cremated together. Common sense suggests that they were, but the nature of cremated remains make them very easy to store. Theoretically, it is possible to save the remains of an individual, and mix them with those of a second, at a later time. Indeed, such an occurrence is mentioned in the Iliad (Book XXIII:108-191). In some cases, a second individual was only inferred based on a single bone fragment. Although the often relatively large amount of unidentified fragments, and the difficulty in separating the bones of two individuals might mask the presence of other bones from a second individual, it still seems as if the individuals are not equally represented. It is possible that a stray fragment, or fragments, found their way into an urn because a pyre site was re-used. However, the few known re-used pyre sites tend to be associated with un-urned cremation burials rather than urned ones, such as at Sketewan and Cloburn Quarry (Mercer and Midgley, 1997; Lelong and Pollard, 1998).

Whether or not the individuals had been cremated together, the decision to mix their remains in a single urn was a conscious one. If animal bones could be largely kept out of urns, it cannot have been difficult to keep the remains of two individuals separate and place them in separate urns. The Anglo-Saxon cremation cemetery at Spong Hill contained some graves with animal accessory vessels, which held most of the animal bones from these graves. The fact that they contain small quantities of human bone, and the main vessel contain small quantities of animal bones suggests that they were cremated together, but were placed in different vessels after collection from the pyre (McKinley, 1994c, 93).

Other cremation burials indicate that two humans could be cremated at the same pyre, but buried separately. An 8th century Swedish grave in a cairn at Klinta, on the Baltic island of Öland, contained a pyre site with the remains of a burnt ship as well as small quantities of bone from two individuals, one man and one woman. The cairn also contained a very rich grave with the cremated remains of a woman and small quantities of the cremated remains of a man. A cairn next to this cairn contained an almost equally rich grave with the cremated remains of the same man. There was some mixture of the human remains and the pyre goods, but it was clear that the two individuals had been cremated together, and that after cremation, their remains, as well as the pyre goods appropriate to their gender, were put into two separate, but adjacent, graves (Rosengren, 2011, 21). The only possible cases of Mainland Scottish Bronze Age urned burials where the remains of two individuals may have been separated is that of small accessory vessels containing infant bones placed inside larger urns with adult bones (e.g. Jobey, 1980).

The frequent pairing of non-adults with adults is interesting, especially since adults are not paired as frequently. Non-adults were overrepresented in the deposits with an MNI of two or more, with only eight non-adults (two foetuses/infants and six children/adolescents) found in the MNI=1 deposits. The data indicates that most adults are found in the MNI=1 deposits, with only just over 4% of the adults found in the MNI=3 deposits.

What were the criteria for being buried together in an urn? In the case of foetuses or neonates buried with adult women, it seems likely that it could represent a case in which mother and child died, during, or shortly after birth. Other types of combinations, such as three non-adults, or two adults, or an adult with a child/adolescent, requires other explanations. Human sacrifice has sometimes been suggested as an explanation, the most popular example being that a woman was killed and cremated with her husband when he died. However, a world-wide study of wife-sacrifice suggests that the custom, albeit very widespread both geographically and temporally, is also very rare (Fisch, 2006, 7).

Cremation is a relatively costly form of burial, since it requires a large amount of firewood or other types of fuel for the pyre apart from pyre/grave goods. It is possible that if two or more individuals died within a short space of time, such as from an infectious disease, they would have been cremated together. It has also been argued that younger non-adults (children and infants) are more difficult to cremate compared to adults. Unless there were very specific circumstances, children and infants would only have been cremated if there was also an adult to cremate, to ensure that cremation was complete (Holck, 2008, 119). Ethnographically, some groups have combined children with adults in graves to ensure that there is someone to care for the child in the other world (Fisch, 2006, 60). It is likely that the reasons behind this overrepresentation of non-adults in deposits with an MNI of >1 are complex, combining what we think of as practical and symbolical reasons.

6.3 An interpretation of the mortuary ritual

In the introduction, it was argued that the purpose of mortuary ritual is the reclassification of an individual from living to dead, and the purpose of this section is to explore what form this took in the case of the urned burials analysed for this thesis. Although far from everything about the ritual can be reconstructed, the interpretation of the results of osteological analysis above makes it possible to reconstruct a sequence of events relating to how the dead body was handled.

Soon after death, the body was prepared for cremation. The remains of pyre goods suggest that, at least in some cases, bodies were dressed in some sort of garment fastened with a bone toggle. The body was placed on a sufficiently large, well-made pyre. It was accompanied by pyre goods, which often included animals as well as bronze objects. In some cases, more than one individual were cremated together. The pyre was lit, and was apparently left to burn without much interference. Not long after the pyre site had cooled enough, the cremated remains were carefully picked from it. Not all of the material from the pyre was placed in the urn. There seems to have been a focus on the human remains, with animal remains and pyre goods not being as important. However, fragments of animal bone and other pyre goods were often included with the human remains. Sometimes remains from more than one individual were buried together. A pit was dug, into which the pyre debris might be placed. The urn was sealed, and then placed, often inverted, into the pit, which was then filled.

The treatment of the body is central to the mortuary ritual. As discussed in the literature review, cremation is sometimes seen as a way of destroying the body to free the soul. Hindu cremation, as performed in both India and Nepal, is a well-known example. In both cases, the cremated remains are dumped into the river once cremation is complete (Parry, 1994; Oestigaard, 2007). Similarly, when early campaigners for the reintroduction of cremation to Europe, one of the main arguments was to destroy the body, which was seen as dirty and contagious and taking up valuable space, in the form of cemeteries, which could be used for other purposes (e.g. Back-Danielsson, 2009).

A prehistoric example of apparently purposefully destructive cremation is that practiced during the Late Bronze Age and Early Iron Age cremation in southern Scandinavia (e.g. Kaliff and Oestigaard, 2004; Häringe Frisberg, 2005;

Aspeborg, 2005; Kaliff, 2007). Burials of this period often contain very small quantities of heavily fragmented remains. In some cases, remains seem to be missing altogether from the graves. Human remains are also found associated with heaps of fire-cracked stones and with grinding stones, and it has been suggested that the mortuary rituals of the period emphasised the destruction of the body, and the returning of its constituent parts to nature, through cremating, grinding and scattering the remains (Kaliff, 2007). However, even purposeful fragmentation of the body need not mean the complete annihilation of the body, but rather removing its identity. The cremation ritual in Late Iron Age southern Scandinavia has been suggested to have been a way to fragment the body, converting it into a powerful substance that could be used in a variety of ways, including in metalworking, as temper in pottery making, and for burying it in important places in houses or on territorial boundaries (Back-Danielsson, 2009).

Cremation in itself does not completely obliterate the body. The destruction of the human remains is a conscious decision by the mourners, who have to grind or scatter the bones. In contrast, groups practicing urned cremations made an effort to *preserve* the body, rather than to destroy it. Whenever people of the past went to the trouble of collecting and depositing the cremated remains of their dead in a container, it must be inferred that the remains retained significance, that they were not merely the remains of the empty shell that had once housed the soul (Arcini, 2007). In a study of a Late Bronze Age Swedish cremation cemetery, Arcini (2005, 67) found that while dog bones were common on the pyre sites, they were much rarer inside the urns. She believed that the reason for this was that the human body retained a specific importance, even after cremation, unlike the dog remains. It was still viewed as the person it had been in life, or at least like a human being, in contrast to the rest of the material from the pyre.

It is therefore argued that, rather than being a way of obliterating the bodies of the dead, urned Bronze Age cremation in Mainland Scotland was a technique for producing a socially and biologically dead body. The state of the body was intimately tied up with the reclassification of an individual from alive to dead. A useful model for understanding the manipulation of the body in the mortuary ritual associated with the Scottish urned cremation burials is that of secondary or double burial, which was discussed in the chapter on mortuary ritual. Secondary burial can be defined as a custom in which the body is temporarily buried in one place, or processed in another way, resulting in the decomposition or removal of the flesh, leaving only the clean bones to be buried in a final act of deposition (Parker Pearson, 1999a, 50). Theories relating to secondary burial date back to a famous article by Hertz (1960), which attempted to make sense out of a variety of mortuary treatments worldwide in which the body was not buried relatively soon after death. Hertz (1960) argued that the desired result of all forms of secondary manipulation of the body was to separate the impure, perishable flesh from the more permanent and pure bones. In this model, the state of the remains was seen as mirroring the state of the soul, which needed to pass from the world of the living to the world of the dead. The intermediary phase - during which the flesh is disappearing - is a dangerous, contagious one, akin to the liminal stage identified by van Gennep (1960).

Hertz (1960) originally formulated his theory using secondary data from Indonesia. Although it has been criticised for being too narrowly focused on the original ethnographic material (Bloch and Parry, 1982a, 3), it has been used to explain a variety of mortuary rituals worldwide (Parker Pearson, 1999a). The theory itself is quite vague, and to be of any use, the particulars of each specific ritual, and the society from which it stems, must be taken into account (Metcalf and Huntington, 1991, 112). For example, different societies might emphasise different parts of the mortuary ritual, with some placing less emphasis on the journey of the soul and more on the processing of the body (Parker Pearson, 1999a, 22). Nevertheless, using a Human Relations Area Files cross-cultural survey, Carr (1995, 191) found strong support for the argument that "mourners often believe that the state of the corpse is a model of the state of the soul, and that the soul can be manipulated by the way in which the corpse is handled".

In European prehistory, perhaps the most famous example of double burial is that associated with the Neolithic megalithic phenomenon of West and Northwest Europe, from c. 4000 BC (Whittle, 1996, 243-244). It has been argued that the megalithic monuments, such as passage graves and dolmens, should not be interpreted as tombs, but rather as mortuary monuments, created for the rites of passage of the dead. The bones were rearranged in the monuments after the flesh had disappeared, and could be brought from one monument to another (Bradley, 1998). Although the Neolithic might be the most well-known example, various types of complex mortuary rituals involving secondary burial have occurred throughout prehistory (e.g. Pettitt, 2011; Nilsson Stutz, 2005; Hedeager, 2010), and into historic (e.g. Weiss-Krejci, 2005) and even modern times (e.g. Seremetakis, 1991). As seen in the chapter on the Bronze Age, there is also evidence of complex mortuary ritual during the Bronze Age, both with and without cremation. This includes the possible burial and exhumation of bodies which were then cremated (MacLaren, 1967).

Hertz (1960, 42-43) specifically argued that cremation burial was a form of double burial, despite seemingly different to the more classic type of double burial at first glance. He suggested that the act of cremation filled the same function as temporary burial, in that it removed the flesh from the bones. The interpretation of cremation as double burial was criticised by Rakita and Buikstra (2005a), using the example of prehistoric cremation in the US southwest. They argued that the aim of cremation in the US southwest was annihilating an individual completely, removing both body and soul from the world of the living and enabling the soul to fully enter the world of the ancestors. Rakita and Buikstra (2005a) used osteological evidence to reinforce their argument, pointing to how cremation burials in the US southwest were highly fragmented and small. They argued that cremation was more destructive than other types of secondary treatments of bodies, claiming that “while the clean, dry skeleton of a corpse is easily recognized as the final remains of an individual, a pile of cremated bone is not” (Rakita and Buikstra, 2005a, 104). However, in the case of Scottish urned cremation burials, this does not seem to be the case. The remains ending up in the urn was mainly that belonging to the dead individual, with only small amounts of pyre debris, animal bones and other pyre goods. Clearly, the mourners were able to distinguish the human remains from the other material.

The ritual sequence tell us of the mourners’ unease about the physical disintegration of the body. The presence of pins and toggles indicate items of clothing; a desire to present the dead as they would have been in life up until the moment when they were placed on the pyre. The lack of cutmarks or any other evidence of the body being cremated defleshed shows that the manipulation of the body at this stage was merely about the surface, including acts such as washing and dressing the dead, rather than more destructive practices such as dismemberment, defleshing or excarnation. It appears to have been important that the boundary of the body, the skin, should remain intact.

Some religions, notably Islam (Turner, 2005) emphasise the need to bury the dead as quickly as possible to avoid decay. In the case of pyre cremation, the period between death and 'burial' (in this case cremation) might have lasted several days, in order to build the pyre (Beowulf, lines 3137-3177) and prepare pyre goods (Parker Pearson, 1999a, chapter 1). Although this is time enough for autolysis and putrefaction to set in (Gill-King, 1997), causing changes in the appearance and scent of the dead body, the degree of these changes would have depended on the surrounding temperature. Storing the body under earth would have been one option in summer (Parker Pearson, 1999a, chapter 1), but in colder weather it would probably have been enough to shelter the body. Meadowsweet (*Filipendula ulmaria*), found in Bronze Age cists (e.g. Tipping, 1994), has been suggested to have been used to mask the scent of bodies beginning to decay, and it is possible that it might have been used as such in connection with cremation. Thus, even if the period between death and cremation stretched out to last for several days, the mourners had strategies to cope with this. Crucially, such a short period of time between death and cremation would not have affected the structural integrity of the body; even bloated and discoloured, the individual would have been recognisable and the boundaries of the body would have remained intact.

As the body was arranged on the pyre - whether supine (e.g. McSweeney, 1997b; Roberts, 1998b) or crouched (e.g. Kilbride-Jones, 1936; Powell, 2001; Dodwell, 2012), together with the pyre goods - the impression must have been very similar to that of an inhumation burial. Just as in the case of an inhumation burial, the tableau of the body surrounded by the pyre goods would have been the last time the mourners saw the dead individual as they had been in life. Indeed, it has been argued that cremation or inhumation of fresh corpses are similar, in that they both distance the mourners from the process of decomposition, by minimising the need to handle a decaying body (Nilsson Stutz, 2005, 346). However, although cremation would speed up the process of breaking down the body, it would not entirely have spared the mourners the sensory impact of decomposition. Williams (2004) presented a very dramatic, perhaps purposefully shocking description of the cremation process, with colourful descriptions of the body moving, sitting up, emitting noises, spurting bodily fluids, and so on. Nevertheless, practitioners with experience of experimental cremation have opposed the view of pyre cremation as smelly and grotesque (Henriksen, 1991; Sigvallius, 1994; Jonuks and Konsa, 2007). From his experiences of experimental cremation Henriksen (1991, 51-52) found that the cremation process was quick and associated with little smell or smoke. This is not to say that watching the dramatic process of cremation of a loved one would not have been both awe-inspiring and frightening. After all, watching a family member being cremated is likely to have been an emotionally different experience than to cremate a pig for experimental purposes.

The reluctance to interfere with the body once cremation began, as suggested by the lack of raking, further emphasises the unease about decomposition. It is possible that the mourners left at this stage, leaving the pyre to burn down on its own, as was the case among Tasmanian Aborigines observed in the 19th century (Hiatt, 1969, 104-105). Like decomposition in secondary burial, cremation might have been viewed as a process over which the mourners had no control once the fire had started. The difference with secondary burial in which the body was left to decompose would have been the timescale. A cremation pyre might have burnt down in less than a day (or a night) (Beck, 2005). As long as the urn was buried relatively soon after the pyre died down, cremation would have drastically reduced the dangerous liminal period, a period during which the mourners were crippled by taboos and, in a sense 'dead' themselves (i.e. van Gennep, 1960; Turner, 1969). The time between the lighting of the pyre and the final burial would have been a dangerous period, probably associated with taboos (Fisch, 2006, 62-63). It would also mark an important change in the mourners' perception of the dead body. From the time the pyre was lit, the remains were seen as unstable; in a state of flux (Goldhahn, 2007; Østigård, 2007; Rebay-Salisbury and Stig Sørensen, 2008a; Rebay-Salisbury, 2010; Hedeager, 2010). Although the liminal period would have begun already when the individual died, the period while the body was burning would have been particularly dangerous.

With the destruction of the soft tissues on the pyre, only the clean bone fragments would remain on the pyre site. No longer identifiable as the person it was in life, and free from the flesh, it was no longer polluting in the way the decaying corpse had been (e.g. Douglas, 1966). The clean bones, while still loaded with meaning, would have been treated in a radically different way than the unburnt body. Part of why the unburnt and burning body was perceived as dangerous and liminal was because it was rapidly changing and not under control (e.g. Nilsson Stutz, 2005). In contrast, the cremated remains were stable and unchanging.

Once the pyre site had cooled down enough, the mourners had to collect the remains - which, if the pyre was not excessively raked, would have been in a largely anatomical order and identifiable as the remains of a human being (e.g. Kilbride-Jones, 1936; McKinley, 1994c; Bohnert et al., 1998; Arcini, 2005; Holck, 2008; Dodwell, 2012) - in order to place them in the urn. The lack of charcoal in the urns, together with the relatively large size of the fragments, suggests that this was done with great care, by picking the fragments one by one rather than raking them together. It is possible that some sort of tools were used to gather the remains. The unburnt tweezers and razors frequently found with Scandinavian Bronze Age cremation burials were supposedly used to collect the cremated remains from the pyre (although no one suggests that this would have been their only purpose) (Thedéen, 2004, 120). Similarly, in modern-day Japan the bones are placed in the urn by the mourners, using eating sticks. The act is highly formal, and carried out in accordance with traditions (Kretschmer, 2005).

The fragmentation and recreation of the body is common to all sorts of secondary burial. To Hertz (1960, 43), the meaning of secondary burial was not to destroy the body, but to change it into a new one. To him, cremation was a prime example. Unlike the cremation process itself, which was arguably something over which the mourners had no control once the fire started, the collection and ordering of the human remains - the building of the new body - was a process in which the mourners were actively engaged (i.e. Seremetakis, 1991).

It is possible that it was therapeutic for the mourners, a way to channel grief and shock into a time-consuming, intricate labour (Seremetakis, 1991; Wysocki and Whittle, 2000), one that would not have been possible, had the dead body simply been buried. It seems to have been a process in which the mourners were no longer restrained by the physical boundaries of the body. While the remains themselves were important, the body was not viewed as a whole that needed to be kept together (Brück, 2006). Not all of the human remains, and apparently not all of the remains of the pyre goods, were placed in the urn. Some part of the cremated remains may have been distributed between the mourners or disposed of in some other manner than by being buried in the urn. At this stage, the remains of various individuals, including animals, could be mingled together. This reveals a marked difference in how the unburnt body and the cremated body were perceived. The unburnt body seems not to have been modified other than by washing and dressing it as if for burial. The burnt, fragmented body - recognised as human, but no longer recognisable as the person it had been in life - on the other hand, could be extensively manipulated.

In their discussion of Early Neolithic human remains in monuments from the Black Mountains, Wales, Wysocki and Whittle (2000, 599) argued that the bone assemblages found, in which the remains of various individuals had been mixed, suggested "concerns with the representations of physical entities and the concept of a human body (if not the individual identity)". Perhaps the most dramatic representation of such composite bodies are burials of skeletons, which, at closer inspection, are revealed to have been constructed from the remains of more than one individual. Examples include one of the Later Bronze Age bodies found at Cladh Hallan, Western Isles (Parker Pearson et al., 2005) and Earlier Neolithic bodies found on the Isle of Man (Fowler, 2002). However, composite bodies can also blur the line between human and animal, as evidenced by Scandinavian burials, ranging from the Mesolithic to the Late Iron Age, in which parts of skeletons have been removed and replaced by animal parts (Jennbert, 2004). The fragmentation seen in cremation burials is perhaps particularly suited for this mixing of bodies (Brück, 2006), and the mixing of various individuals as well as the mixing of human and animal occurs in cremation burials as well. Conspicuous examples include burials of the Nordic Bronze Age, in which cremated remains in cists have been laid out resembling an unburnt body, but which may consist of more than one individual (Goldhahn, 2009; Stig Sørensen, 2010). The occurrence of animal bones in cremation burials have also been argued to be a very conscious process, perhaps related to shamanic practices, in which the differences between human and animal blurred (Williams, 2001).

The new body of burnt bones was a fragile one, no longer bound by its skin (Rebay-Salisbury and Stig Sørensen, 2008b), and the urn would have created a new boundary. It might be wrong to view the urn itself as part of this new body. After all, some cremation burials were simply buried in organic bags, without an urn. With its link to the household, due to its possible use for cooking before its use in the mortuary ritual (MacGregor, 1998, 147), the urn could be argued to symbolise the house of the new body. Inside it, the mingling of individuals who might have belonged to the same household in life would have made sense. Indeed, the urn, when inverted, would have resembled the house that the dead person had inhabited in life (Edwards, 1935). The burial would have been a definitive end to the handling of the body, as unlike some cists, urns were not meant to be reopened or tampered with once buried. Turning the urn upside down would have marked the end of the ritual. Perhaps it symbolised the inverse relation of the world of the dead to the world of the living. The deceased was finally dead, both biologically and socially.

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Chapter 7

Conclusion

7.1 Summary of results

The thesis presented a reconstruction of the mortuary ritual associated with urned cremation burial in Bronze Age Scotland. Focusing on the treatment of the dead body, a sequence of what happened to the body before, during and after cremation was offered. It was suggested that, rather than being a way of obliterating the bodies of the dead, cremation followed by burial in an urn was a technique for producing a body that was socially as well as biologically dead.

The osteological material analysed for the thesis consisted of cremated remains from 75 urns from 50 sites on the Scottish Mainland, a significant contribution to the number of recently analysed urned cremation burials in Scotland. Most had not been previously analysed. 19 of the cremation burials had been radiocarbon dated, a further 44 could be typologically dated using the urn. The rest could only be classified as Bronze Age.

Overall, the material was relatively well-preserved. In total, a minimum of 103 individuals were identified from the 75 deposits. As expected, the majority of the deposits contained were single burials. The number of deposits with an MNI of two or more was higher than in other studies of Bronze Age cremation burials. 20 deposits, 32%, contained more than one individual. Out of these, sex could be determined on 38 individuals. 16 were classed as likely females and 22 as likely males. Age was described using very broad age categories: foetal/infant, child/adolescent and adult. The majority of the individuals, 71, were classed as adult. 24 of the individuals were classed as children/adolescents. Only eight individuals were classed as foetal/infants. Estimations of age and sex were dependent on the indicators available, which varied considerably between deposits. Sex determination was therefore often dependant on sexually dimorphic elements of the skull. For this reason, no individual was sexed with 100% certainty.

The distribution of aged and sexed individuals was compared to the MNI. The relatively small proportion of individuals of known sex makes it problematic to discuss the distribution of males and females in relation to MNI. As all individuals could be placed into an age category, this is a more valuable parameter. The results suggest that over 60% of the adults are found in the MNI=1 deposits and less than 5% in the MNI=3 category. For non-adults, the figures are quite different. Only 25% of the individuals classed as foetal/infant and 25% of the ones classed as children/adolescents were found in the MNI=1 deposits. When grouping the non-adults into one category, it was clear that non-adults were over-represented in the deposits containing an MNI of more than one.

The bone weights of individuals of known sex from MNI=1 deposits were compared. This suggested that individuals classed as male weighed slightly more than those classed as females, which in turn weighed more than those classed as being of unknown sex. The fact that those of unknown sex weighed less could be due to the fact that several of those are non-adults. However, it is also likely that deposits containing less bone are more difficult to sex.

Only 16 of the 103 individuals showed any sign of pathology/non-metric variation. This has to be taken as an absolute minimum, as not all pathologies are visible on the skeleton, and as the fire itself can destroy evidence of certain conditions. Most of the pathologies/non-metric variations identified were pathologies of the spine, followed by dental pathologies/non-metric variation.

Areas of poor calcination on the bones were recorded from identified fragments. Roughly a quarter of the identified fragments showed evidence of poor calcination. The distribution of poor calcination in the body indicated that the axial skeleton was the most completely calcined part, whereas the skull showed most signs of poor calcination. When studied in more detail, the distribution indicated that, in most cases, skeletal elements which were more exposed tended to be better burned. An analysis of the MNI=1 deposits suggested that males were more completely calcined than females, who in turn were more completely calcined than the individuals of unknown sex. It was also suggested that adults were more completely calcined than children/adolescents, while foetal/infant remains had the highest level of poor calcination. Both the analysis of sex and age were hampered by the quantity of material in each category.

Pyre goods were found in 17 of the deposits. It consisted of worked and unworked animal bone as well as chunks of flint. Unworked animal bone was the most common type of pyre goods, followed by worked bone. Flint was the least common. Turquoise stains on the bones, possibly from the presence of copper alloys, were found in 55 of the deposits. The level of staining varied considerably, both regarding the number of stains and the intensity of the stains. Stains were most common in the skull fragments and less common in the lower limb. Charcoal from the pyre was not very common. It was only found in 17 of the deposits, although it is possible that it is slightly underrepresented due to many of the deposits being from older excavations.

The calcination patterns indicate that the bodies were cremated as fleshed bodies. That at least some of them were dressed is indicated by the presence of bone toggles and pins, as well as sheep/goat phalanges and metatarsals possibly indicating an infant wrapped in a sheepskin. The pyres were large and well-made, ensuring a high degree of calcination. It was not possible to reconstruct the position of the body on the pyre, due to conflicting findings and the lack of research into the topic.

Bronze seems to have been a very common pyre goods, based on stains found on the bones. It seems as if it might have been more common in urned cremation burials than in un-urned ones. Animal bones were not as common. The lack of cutmarks indicate that the animals were complete carcasses and not just meat joints.

The relatively low degree of fragmentation suggests that the pyres were left to burn without too much interference until they burned down. It also suggests that the fragments were not left for long on the pyre site. The remains were picked carefully from the pyre site, as very little charcoal was found in the deposits. Despite this, not all of the material from the pyre was placed in the urn.

Animal bone was only ever present in small quantities, and the human remains never represented a complete body. In some cases, remains from more than one individual were buried together. This was more common than expected, with almost a third of the urns containing multiple individuals.

7.2 An interpretation of the mortuary ritual

The results of the osteological analysis were used to recreate the sequence of events of the mortuary ritual. After death, while the body was still fresh and intact, it was prepared for cremation. At least in some cases, bodies were dressed or shrouded. A sufficiently large, well-made pyre was built and the body was placed on it together with the pyre goods, which often included animals as well as bronze objects. In some cases, more than one individual were cremated together. The pyre was lit, and left to burn without much interference. Not long after the pyre had burned down and the pyre site had cooled down, the cremated remains were carefully picked from it. Not all of the material from the pyre was placed in the urn, and there seems to have been a focus on the human remains, with animal remains and pyre goods not being as important. In almost a third of the cases, remains from more than one individual were buried together. A pit was dug, and in some cases the pyre debris was placed inside it. The urn was sealed, and then placed, often inverted, into the pit, which was then filled.

It was suggested that instead of viewing cremation as a way of destroying the body, it is more appropriate to think of it as a type of secondary or double burial aimed at producing a body that was socially as well as biologically dead. Double burials are mortuary rituals in which the body is first treated in a way to remove the flesh from the bones before the bones are buried. The cremation process broke down the body, which was then recreated by the mourners before its final deposition in the urn. This would have been a creative process, in that body parts could be added or removed.

It was argued that the treatment of the body indicates an unease relating to the physical disintegration of the body, whether from advanced decay or from cultural practices such as defleshing, dismemberment and excarnation.

This is indicated by how the body was put on the pyre still complete and fleshed, and by how the mourners might have left the pyre to burn on its own, only returning later to collect the clean bones from the pyre site. The act of cremation shortened the liminal period, which would have been much longer had the body been subjected to other types of secondary burial. The collection of the remains and their placement in the urn was a creative act. Not all of the remains were necessarily included in the urn, and various individuals and even small parts of animals could be mixed together. The mortuary ritual reveals a marked difference in how the unburnt body and the cremated body were perceived. The unburnt body seems not to have been modified other than by washing and dressing it as if for burial. The burnt, fragmented body - no longer recognisable as the person it had been in life - on the other hand, could be extensively manipulated.

7.3 Contributions

This thesis has made contributions to Bronze Age research as well as osteological research. It has added significantly to the corpus of osteologically analysed Bronze Age urned cremation burials, and provided an interpretation of the mortuary ritual. The osteological contribution includes a methodology for using calcination patterns to suggest whether the body was fleshed or not when it was cremated, instead of using warping and fracture patterns, a method that is suggested to be unsatisfactory.

7.4 Further research

The osteological analysis of the cremated remains revealed two interesting findings. Both turquoise stains, suggesting copper alloys, and multiple burials, were more common than expected. More research will determine whether this is a feature particular to urned burials compared to other types of cremation burial. Furthermore, chemical analysis of the stains will reveal more about the role of bronze objects in the cremation ritual.

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